PROJECT TITLE Library Renovation
Canada Centre for Inland Waters
Burlington, Ontario
Issued for Tender

PROJECT NUMBER R.061475.001

PROJECT NAME 2013-12-09 (ISSUED FOR BID)

END

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PART 1 - GENERAL

1.1 SECTION INCLUDES

.1 Title and description of Work.

.2 Contract Method.

.3 Site mobilization.

.4 Cost breakdown.

.5 Work sequence.

.6 Contractor use of premises.

.7 Owner occupancy.

.8 Alterations to existing building.

.9 Canada Centre for Inland Waters (CCIW) Documentation.

1.2 WORK COVERED BY CONTRACT DOCUMENTS

.1 Work of this Contract comprises renovation of the library in the Canada Centre for Inland Waters building, located at 867 Lakeshore Road, in Burlington, Ontario.

1.3 CONTRACT METHOD

.1 Construct work under lump sum contract.

1.4 SITE MOBILIZATION

.1 Contractor must mobilize to construction/demolition Work for this Project within 48 hours of signing the Contract.

1.5 COST BREAKDOWN

.1 Within 48 hours of notification of acceptance of bid furnish a cost breakdown by Section aggregating contract price.

.2 Within 48 hours of acceptance of bid submit a list of subcontractors.

1.6 WORK SEQUENCE

.1 Coordinate Progress Schedule.

.2 Maintain fire access/control.

1.7 CONTRACTOR USE OF PREMISES

.1 Contractor shall limit use of premises for Work, for storage and for access to specific floor on which renovation work is to occur.

.2 Coordinate use of premises under direction of Departmental Representative.

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

1.8 OWNER OCCUPANCY

.1 Owner will occupy other floors of existing building during the entire construction period for execution of normal operations.

.2 Cooperate with Owner in scheduling operations to minimize conflict and to facilitate Owner usage.

1.9 ALTERATIONS TO EXISTING BUILDING

.1 Remove in good order, turn over to Department, and store within building where designated by Departmental Representative:
.1 Items as indicated in Section 02 41 19.

.2 Remove, temporarily store, clean, alter to suit and reinstall:
.1 Items as indicated in Section 02 41 19.

.3 Remove, temporarily store and turn over to other sections for building in:
.1 Items as indicated in Section 02 41 19.

.4 Provide new openings required in existing construction.

.5 Block in openings where items are removed with material and finish to match existing adjoining construction.

.6 If required, undercut existing doors to clear new floor finish.

1.10 CANADA CENTRE FOR INLAND WATERS DOCUMENTATION

.1 Refer to files attached to the end of this document provided by the Canada Centre for Inland Waters (CCIW) that are to apply to Work of this Project. The Documents are to include the following:
.1 Worker Profile Sheet - Annex 'B'.
.2 Hot Work Permit - Annex 'C'.

1.10 CANADA CENTRE FOR INLAND WATERS DOCUMENTATION (Cont'd)

.1 (Cont'd)
.3 Hot Tap Permit - Annex 'D'.
.4 Isolation Procedures - Annex 'E'.
.5 'Live' Work Procedure - Annex 'F'.
.6 2nd Floor Mechanical Space - Mandatory Safe Working Practices - Annex 'G'.
.7 Emergency and Fire Evacuation Route - Annex 'H'.
.8 'Canada Centre for Inland Waters (CCIW) Building and Property Technical Services (BPTS) Lock Out Tag Out (LOTO) reference'.

PART 2 - PRODUCTS

2.1 NOT USED

.1 Not used.

PART 3 - EXECUTION

3.1 NOT USED

.1 Not used.

END

PART 1 - GENERAL

1.1 SECTION INCLUDES

.1 Connecting to existing site services.

.2 Special scheduling requirements.

.3 Security clearance and requirements.

1.2 ACCESS AND EGRESS

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

1.3 USE OF SITE AND FACILITIES

.1 Execute work with least possible interference or disturbance to normal use of premises. Make arrangements with Departmental Representative to facilitate work as stated.

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

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

.4 Departmental Representative will assign sanitary facilities for use by Contractor's personnel. Keep facilities clean.

.5 Use only elevators existing in building for moving workers and material.
.1 Protect walls of passenger elevators, to approval of Departmental Representative prior to use.
.2 Accept liability for damage, safety of equipment and overloading of existing equipment.

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

1.4 ALTERATIONS, ADDITIONS OR REPAIRS TO EXISTING BUILDING

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

1.5 EXISTING SERVICES

.1 Notify, Departmental Representative utility companies of intended interruption of services and obtain required permission.

.2 Where Work involves breaking into or connecting to existing services, give Departmental Representative 48 hours of notice for necessary interruption of mechanical or electrical service throughout course of work. Keep duration of interruptions minimum. Carry out interruptions after normal working hours of occupants, preferably on weekends and as approved by the Owner.

.3 Provide for pedestrian and vehicular traffic.

.4 Construct barriers in accordance with Section 01 56 00.

1.6 SPECIAL REQUIREMENTS

.1 Site access: Normal working hours are Monday to Friday, from 7:00 a.m. to 6:00 p.m. If the Contractor must work after hours, this scheduling must be pre-arranged with the Environment Canada site contact and security will be provided by the Owner for all after hours work.

.2 Submit schedule in accordance with Section 01 32 16 - Construction Progress Schedule - Bar (GANTT) Chart.

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

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

1.7 SECURITY

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

1.7 SECURITY (Cont'd)

.2 Security clearances and requirements:

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

.2 Obtain requisite clearance, as instructed, for each individual required to enter premises.

.3 Personnel will be checked daily at start of work shift and provided with pass which must be worn at all times. Pass must be returned at end of work shift and personnel checked out.

.4 A site foreman is to be retained by the General Contractor and must be present at all times during construction work and escort individuals to and from the site and be responsible for all employees' access. A site foreman will be provided with an access card after a security check has been performed by PWGSC/Environment Canada. A list of the employees of the General Contractor and subtrades is to be provided to security in advance. All of the Contractor's employees must sign in and out daily at the security desk.

1.8 BUILDING SMOKING ENVIRONMENT

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

PART 2 - PRODUCTS

2.1 NOT USED

.1 Not Used.

PART 3 - EXECUTION

3.1 NOT USED

.1 Not Used.

END

PART 1 - GENERAL

1.1 SECTION INCLUDES

.1 Inspection and testing by inspecting firms or testing laboratories designated by the Departmental Representative.

1.2 APPOINTMENT AND PAYMENT

.1 Departmental Representative will appoint and pay for services of testing laboratory except follows:
.1 Inspection and testing required by laws, ordinances, rules, regulations or orders of public authorities.
.2 Inspection and testing performed exclusively for Contractor's convenience.
.3 Testing, adjustment and balancing of conveying systems, mechanical and electrical equipment and systems.
.4 Mill tests and certificates of compliance.
.5 Tests specified to be carried out by Contractor under supervision of Departmental Representative.

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

1.3 CONTRACTOR'S RESPONSIBILITIES

.1 Provide labour, equipment and facilities to:
.1 Provide access to Work for inspection and testing.
.2 Facilitate inspections and tests.
.3 Make good Work disturbed by inspection and test.
.4 Provide storage on site for laboratory's exclusive use to store equipment and cure test samples.

.2 Notify Departmental Representative 48 hours minimum sufficiently in advance of operations to allow for assignment of laboratory personnel and scheduling of test.

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

1.3 CONTRACTOR'S RESPONSIBILITIES (Cont'd)

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

PART 2 - PRODUCTS

2.1 NOT USED

.1 Not Used.

PART 3 - EXECUTION

3.1 NOT USED

.1 Not Used.

END

PART 1 - GENERAL

1.1 ADMINISTRATIVE

.1 Schedule and administer project meetings throughout the progress of the work at the call of Departmental Representative.

.2 Prepare agenda for meetings.

.3 Distribute written notice of each meeting 4 days in advance of meeting date to Departmental Representative.

.4 Provide physical space and make arrangements for meetings.

.5 Preside at meetings.

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

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

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

1.2 PRECONSTRUCTION MEETING

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

.2 Departmental Representative, Contractor, major Subcontractors, field inspectors and supervisors will be in attendance.

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

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

1.2 PRECONSTRUCTION MEETING (Cont'd)

.5 Agenda to include:

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

.2 Schedule of Work: in accordance with Section 01 32 16.

.3 Schedule of submission of shop drawings, samples, mock-ups, colour chips. Submit submittals in accordance with Section 01 33 00.

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

.5 Delivery schedule of specified equipment in accordance with Section 01 32 16.

.6 Site security in accordance with Sections 01 14 00 and 01 56 00.

.7 Health and safety in accordance with Section 01 35 29.

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

.9 Owner provided products.

.10 Record drawings and specifications in accordance with Section 01 33 00.

.11 Maintenance manuals in accordance with Section 01 78 00.

.12 Take-over procedures, acceptance, warranties in accordance with Section 01 78 00.

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

.14 Appointment of inspection and testing agencies or firms.

.15 Insurances, transcript of policies.

1.3 PROGRESS MEETINGS

.1 During course of Work and two (2) weeks prior to project completion, schedule progress meetings bi-weekly.

.2 Contractor, major Subcontractors involved in Work and Departmental Representative are to be in attendance.

.3 Notify parties minimum seven(7) days prior to meetings.

.4 Record minutes of meetings and circulate to attending parties and affected parties not in attendance within five (5) days after meeting.

1.3 PROGRESS MEETINGS (Cont'd)

.5 Agenda to include the following:
.1 Review, approval of minutes of previous meeting.
.2 Review of Work progress since previous meeting.
.3 Field observations, problems, conflicts.
.4 Problems which impede construction schedule.
.5 Review of off-site fabrication delivery schedules.
.6 Corrective measures and procedures to regain projected schedule.
.7 Revision to construction schedule.
.8 Progress schedule, during succeeding work period.
.9 Review submittal schedules: expedite as required.
.10 Maintenance of quality standards.
.11 Review proposed changes for affect on construction schedule and on completion date.
.12 Other business.

PART 2 - PRODUCTS

2.1 NOT USED

.1 Not Used.

PART 3 - EXECUTION

3.1 NOT USED

.1 Not Used.

END

PART 1 - GENERAL

1.1 DEFINITIONS

.1 Activity: element of Work performed during course of Project. Activity normally has expected duration, and expected cost and expected resource requirements. Activities can be subdivided into tasks.

.2 Bar Chart (GANTT Chart): graphic display of schedule-related information. In typical bar chart, activities or other Project elements are listed down left side of chart, dates are shown across top, and activity durations are shown as date-placed horizontal bars. Generally Bar Chart should be derived from commercially available computerized project management system.

.3 Baseline: original approved plan (for project, work package, or activity), plus or minus approved scope changes.

.4 Construction Work Week: Monday to Friday, inclusive, will provide five day work week and define schedule calendar working days as part of Bar (GANTT) Chart submission.

.5 Duration: number of work periods (not including holidays or other nonworking periods) required to complete activity or other project element. Usually expressed as workdays or workweeks.

.6 Master Plan: summary-level schedule that identifies major activities and key milestones.

.7 Milestone: significant event in project, usually completion of major deliverable.

.8 Project Schedule: planned dates for performing activities and the planned dates for meeting milestones. Dynamic, detailed record of tasks or activities that must be accomplished to satisfy Project objectives. Monitoring and control process involves using Project Schedule in executing and controlling activities and is used as basis for decision making throughout project life cycle.

.9 Project Planning, Monitoring and Control System: overall system operated by Departmental Representative to enable

1.1 DEFINITIONS (Cont'd)

.9 (Cont'd) monitoring of project work in relation to established milestones.

1.2 REQUIREMENTS

.1 Ensure Master Plan and Detail Schedules are practical and remain within specified Contract duration.

.2 Plan to complete Work in accordance with prescribed milestones and time frame.

.3 Limit activity durations to maximum of approximately 10 working days, to allow for progress reporting.

.4 Ensure that it is understood that Award of Contract or time of beginning, rate of progress, Certificate of Substantial Performance and Certificate of Completion as defined times of completion are of essence of this contract.

1.3 SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00.

.2 Submit to Departmental Representative within ten (10) working days of Award of Contract Bar (GANTT) Chart as Master Plan for planning, monitoring and reporting of project progress.

.3 Submit Project Schedule to Departmental Representative within 5 working days of receipt of acceptance of Master Plan.

1.5 MASTER PLAN

.1 Structure schedule to allow orderly planning, organizing and execution of Work as Bar Chart (GANTT).

.2 Departmental Representative will review and return revised schedules within 5 working days.

.3 Revise impractical schedule and resubmit within 5 working days.

.4 Accepted revised schedule will become Master Plan and be used as baseline for updates.

1.6 PROJECT SCHEDULE

.1 Develop detailed Project Schedule derived from Master Plan.

.2 Ensure detailed Project Schedule includes as minimum milestone and activity types as follows:
.1 Award.
.2 Shop Drawings, Samples.
.3 Permits.
.4 Mobilization.
.11 Interior Architecture (Walls, Floors and Ceiling).
.12 Plumbing.
.13 Lighting.
.14 Electrical.
.15 Piping.
.16 Controls.
.17 Heating, Ventilating, and Air Conditioning.
.18 Millwork.
.19 Fire Systems.
.20 Testing and Commissioning.
.21 Supplied equipment long delivery items.
.22 Departmental Representative supplied equipment required dates.

1.7 PROJECT SCHEDULE REPORTING

.1 Update Project Schedule on weekly basis reflecting activity changes and completions, as well as activities in progress.

.2 Include as part of Project Schedule, narrative report identifying Work status to date, comparing current progress to baseline, presenting current forecasts, defining problem areas, anticipated delays and impact with possible mitigation.

1.8 PROJECT MEETINGS

.1 Discuss Project Schedule at regular site meetings specified in Section 01 31 19, identify activities that are behind schedule and provide measures to regain slippage. Activities considered behind schedule are those with projected start or completion dates later than current approved dates shown on baseline schedule.

.2 Weather related delays with their remedial measures will be discussed and negotiated.

PART 2 - PRODUCTS

2.1 NOT USED .1 Not used.

PART 3 - EXECUTION

3.1 NOT USED .1 Not used.

END

PART 1 - GENERAL

1.1 ADMINISTRATIVE

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

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

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

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

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

.6 Notify Departmental Representative, in writing at time of submission, identifying deviations from requirements of Contract Documents stating reasons for deviations.

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

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

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

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

1.1 ADMINISTRATIVE (Cont'd)

.11 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 ftp, as directed by Departmental Representative.

1.2 SHOP DRAWINGS AND PRODUCT DATA

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

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

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

.4 Allow 5 working days for Departmental Representative's review of each submission.

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

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

.7 Accompany submissions with transmittal letter, in duplicate, containing:
.1 Date.
.2 Project title and number.
.3 Contractor's name and address.
.4 Identification and quantity of each shop drawing, product data and sample.

1.2 SHOP DRAWINGS AND PRODUCT DATA (Cont'd)

.7 (Cont'd)
.5 Other pertinent data.

.8 Submissions shall include:
.1 Date and revision dates.
.2 Project title and number.
.3 Name and address of:
.1 Subcontractor.
.2 Supplier.
.3 Manufacturer.
.4 Contractor's stamp, signed by Contractor's authorized representative certifying approval of submissions, verification of field measurements and compliance with Contract Documents.
.5 Details of appropriate portions of Work as applicable:
.1 Fabrication.
.2 Layout, showing dimensions, including identified field dimensions, and clearances.
.3 Setting or erection details.
.4 Capacities.
.5 Performance characteristics.
.6 Standards.
.7 Operating weight.
.8 Wiring diagrams.
.9 Single line and schematic diagrams.
.10 Relationship to adjacent work.

.9 After Departmental Representative's review, distribute copies.

.10 Submit three hard copies and one electronic copy of shop drawings for each requirement requested in specification Sections and as Departmental Representative may reasonably request.

.11 Submit three hard copies and one 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.

.12 Submit three hard copies and one electronic copy of test reports for requirements requested in specification Sections and as requested by Departmental Representative.
.1 Report signed by authorized official of testing laboratory that material, product or system identical to material, product or

1.2 SHOP DRAWINGS AND PRODUCT DATA (Cont'd)

.12 (Cont'd)
.1 (Cont'd)
system to be provided has been tested in accord with specified requirements.
.2 Testing must have been within 3 years of date of contract award for project.

.13 Submit three hard copies and one electronic copy of certificates for requirements requested in specification Sections and as requested by Departmental Representative.
.1 Statements printed on manufacturer's letterhead and signed by responsible officials of manufacturer of product, system or material attesting that product, system or material meets specification requirements.
.2 Certificates must be dated after award of project contract complete with project name.

.14 Submit three hard copies and one electronic copy of manufacturers instructions for requirements requested in specification Sections and as requested by Departmental Representative.
.1 Pre-printed material describing installation of product, system or material, including special notices and Material Safety Data Sheets concerning impedances, hazards and safety precautions.

.15 Submit three hard copies and one electronic copy of Manufacturer's Field Reports for requirements requested in specification Sections and as requested by Departmental Representative.

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

.17 Submit three hard copies and one electronic copy of Operation and Maintenance Data for requirements requested in specification Sections and as requested by Departmental Representative.

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

.19 If upon review by Departmental Representative, no errors or omissions are discovered or if only minor corrections are made, copies will be returned and fabrication

1.2 SHOP DRAWINGS AND PRODUCT DATA (Cont'd)

.19 (Cont'd)
and installation of Work may proceed. If shop drawings are rejected, noted copy will be returned and resubmission of corrected shop drawings, through same procedure indicated above, must be performed before fabrication and installation of Work may proceed.

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

1.3 SAMPLES

.1 Submit for review samples in duplicate as requested in respective specification Sections. Label samples with origin and intended use.

.2 Deliver samples prepaid to Departmental Representative's business address.

.3 Notify Departmental Representative in writing, at time of submission of deviations in samples from requirements of Contract Documents.

.4 Where colour, pattern or texture is criterion, submit full range of samples.

.5 Adjustments made on samples by Departmental Representative are not intended to change Contract Price. If adjustments affect value of Work, state such in writing to Departmental Representative prior to proceeding with Work.

1.3 SAMPLES (Cont'd)

.6 Make changes in samples which Departmental Representative may require, consistent with Contract Documents.

.7 Reviewed and accepted samples will become standard of workmanship and material against which installed Work will be verified.

1.4 MOCK-UPS

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

1.5 PHOTOGRAPHIC DOCUMENTATION

.1 Submit electronic and hard copy of colour digital photography in jpg format, fine resolution monthly with progress statement and as directed by Departmental Representative.

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

.3 Number of viewpoints: 2 locations.
.1 Viewpoints and their location as determined by Departmental Representative.

.4 Frequency of photographic documentation: as directed by Departmental Representative.

1.6 FEES, PERMITS AND CERTIFICATES

.1 Provide authorities having jurisdiction with information requested.

.2 Pay fees and obtain certificates and permits required.

.3 Furnish certificates and permits.

.4 Submit acceptable certificate stating that suspended ceiling systems provide adequate support for electrical fixtures, as required by current bulletin of Electrical Inspection Department of Burlington Hydro.

PART 2 - PRODUCTS

2.1 NOT USED .1 Not Used.

PART 3 - EXECUTION

3.1 NOT USED .1 Not Used.

END

PART 1 - GENERAL

1.1 REFERENCES

.1 Canadian Standards Association (CSA): Canada
.1 CSA S350-M1980(R2003), Code of Practice for Safety in Demolition of Structures.

.2 National Building Code 2010 (NBC):
.1 NBC 2010, Division B, Part 8 Safety Measures at Construction and Demolition Sites.

.3 National Fire Code 2010 (NFC):
.1 NFC 2010, Division B, Part 5 Hazardous Processes and Operations, subsection 5.6.1.3 Fire Safety Plan.

.4 Province of Ontario:
.1 Occupational Health and Safety Act Revised Statutes of Ontario 1990, Chapter O.1 as amended, and Regulations for Construction Projects, O. Reg. 213/91 as amended.
.2 O. Reg. 490/09, Designated Substances.
.3 Workplace Safety and Insurance Act, 1997.
.4 Municipal statutes and authorities.

.5 Treasury Board of Canada Secretariat (TBS):
.1 Treasury Board, Fire Protection Standard April 1, 2010 www.tbs-sct.gc.ca/pol/doc-eng.aspx ?id=17316&section=text.

.6 CCIW Documentation including Annexes and the Lock Out Tag Out (LOTO) summary file as mentioned in this Section and appended at the end of this Document.

1.2 SUBMITTALS

.1 Make submittals in accordance with Section 01 33 00.

.2 Submit site-specific Health and Safety Plan: Within 7 days after date of Notice to Proceed and prior to commencement of Work. Health and Safety Plan must include:
.1 Results of site specific safety hazard assessment.
.2 Results of safety and health risk or hazard analysis for site tasks and operations found in work plan.
.3 Measures and controls to be implemented to address identified safety hazards and risks.

1.2 SUBMITTALS (Cont'd)

.2 (Cont'd)

.4 Provide a Fire Safety Plan, specific to the work location, in accordance with NBC, Division B, Article 8.1.1.3 prior to commencement of work. The plan shall be coordinated with, and integrated into, the existing Emergency Procedures and Evacuation Plan in place at the site. Deliver two copies of the Fire Safety Plan to the Departmental Representative not later than 14 days before commencing work. The Contractor must obtain training of procedures of evacuating the Site under emergency and/or fire situations. Contractor training and sign-off is required prior to initiating Site Work. Refer to sample file Annex "H" appended to the end of this Document.

.5 Contractor's and Sub-contractors' Safety Communication Plan.

.6 Contingency and Emergency Response Plan addressing standard operating procedures specific to the project site to be implemented during emergency situations. Coordinate plan with existing Emergency Response requirements and procedures provided by Departmental Representative.

.3 Departmental Representative will review Contractor's site-specific Health and Safety Plan and provide comments to Contractor within 10 days after receipt of plan. Revise plan as appropriate and resubmit plan to Departmental Representative within 5 days after receipt of comments from Departmental Representative.

.4 Departmental Representative's review of Contractor's final Health and Safety plan should not be construed as approval and does not reduce the Contractor's overall responsibility for construction Health and Safety.

.5 Submit names of personnel and alternates responsible for site safety and health.

.6 Submit records of Contractor's Health and Safety meetings when requested.

.7 Submit 2 copies of Contractor's authorized representative's work site health and safety inspection reports to Departmental Representative, weekly.

1.2 SUBMITTALS (Cont'd)

.8 Submit copies of orders, directions or reports issued by health and safety inspectors of the authorities having jurisdiction.

.9 Submit copies of incident and accident reports.

.10 Submit Material Safety Data Sheets (MSDS).

.11 Submit Workplace Safety and Insurance Board (WSIB)- Experience Rating Report.

1.3 FILING OF NOTICE

.1 File Notice of Project with Provincial authorities prior to commencement of Work.

1.4 WORK PERMIT

.1 Obtain building permits related to project prior to commencement of Work.

.2 Obtain Hot Work Permit, Lockout tag out procedures to hot work and all permits from the Owner.

.3 Worker Profile Sheet: The Contractor shall submit to the Departmental Representative a completed Worker Profile Sheet complete with all attachments including copies of licenses, certificates and permits for supporting qualifications to perform required work for a given Project for each individual worker requiring access to the site. The completed Worker Profile Sheets are required for each individual worker prior to working on site. Refer to sample file Annex "B" appended to the end of this Document.

.4 Hot Work Permit: The Contractor shall submit a completed Hot Work Permit to the Departmental Representative for review and approval. The Departmental Representative's approval is required prior to initiating hot work. Refer to sample file Annex "C" appended to the end of this Document.

.5 Hot Tap Permit: The Contractor shall submit a completed Hot Tap Permit to the Departmental Representative for review and approval. Approval by the Departmental Representative is required prior to initiating hot tap work. Refer to sample file Annex "D" appended to the end of this Document.

1.4 WORK PERMIT (Cont'd)

.6 Lock Out and Tag Out (LOTO) - Isolation Procedures: The Contractor shall submit a completed LOTO Isolation Form (Zero Energy) to the Departmental Representative for review and approval for all work requiring LOTO. The Departmental Representative's approval of isolation form is required prior to initiating LOTO work. Refer to sample file Annex "E" and file entitled, 'Canada Centre for Inland Waters (CCIW) Building and Property Technical Services (BPTS) Lock Out Tag Out (LOTO) reference' appended to the end of this Document.

.7 Live Work Procedure: The Contractor shall submit a completed Live Work Procedure Form to the Departmental Representative for review and approval for all work requiring Live Work procedures. The Departmental Representative's approval of the Live Work Form is required prior to initiating Live Work. Refer to sample file Annex "F" appended to the end of this Document.

.8 2nd Floor Mechanical Space - Mandatory Safe Working Practices: The Contractor shall obtain training from the Departmental Representative on safe working practices and procedures for the 2nd floor mechanical space for each worker requiring access to the 2nd floor mechanical space. The Contractor shall sign-off individual training forms prior to individual workers being authorized access to the 2nd floor mechanical space. Refer to sample file Annex "G" appended to the end of this Document.

1.5 SAFETY ASSESSMENT

.1 Perform site specific safety hazard assessment related to project.

1.6 MEETINGS

.1 Schedule and administer Health and Safety meeting with Departmental Representative prior to commencement of Work.

1.7 REGULATORY REQUIREMENTS

.1 Comply with the Acts and regulations of the Province of Ontario.

.2 Comply with specified standards and regulations to ensure safe operations at site.

1.8 PROJECT/SITE CONDITIONS

.1 Hazardous materials:
.1 Refer to 'Designated Substances Survey' appended to this Document for all potential hazardous substances.
.2 Cease operations and notify the Departmental Representative immediately for special protective and disposal instructions if hazardous materials are uncovered during work of this Section.

1.9 GENERAL REQUIREMENTS

.1 Develop written site-specific Health and Safety Plan based on hazard assessment prior to beginning site Work and continue to implement, maintain, and enforce plan until final demobilization from site. Health and Safety Plan must address project specifications.

.2 Departmental Representative may respond in writing, where deficiencies or concerns are noted and may request re-submission with correction of deficiencies or concerns either accepting or requesting improvements.

.3 Relief from or substitution for any portion or provision of minimum Health and Safety standards specified herein or reviewed site-specific Health and Safety Plan shall be submitted to Departmental Representative in writing.

1.10 COMPLIANCE REQUIREMENTS

.1 Comply with Ontario Occupational Health and Safety Act, R.S.O. 1990 Chapter 0.1, as amended.

1.11 RESPONSIBILITY

.1 Be responsible for health and safety of persons on site, safety of property on site and for protection of persons adjacent to site and environment to extent that they may be affected by conduct of Work.

.2 Comply with and enforce compliance by employees with safety requirements of Contract Documents, applicable federal, provincial, territorial and local statutes, regulations, and ordinances, and with site-specific Health and Safety Plan.

1.11 RESPONSIBILITY (Cont'd)

.3 Where applicable the Contractor shall be designated "Constructor", as defined by Occupational Health and Safety Act for the Province of Ontario.

1.12 UNFORESEEN HAZARDS

.1 Should any unforeseen or peculiar safety-related factor, hazard, or condition become evident during performance of Work, immediately stop work and advise Departmental Representative verbally and in writing.

.2 Follow procedures in place for Employees Right to Refuse Work as specified in the Occupational Health and Safety Act for the Province of Ontario.

1.13 HEALTH AND SAFETY CO-ORDINATOR

.1 Employ and assign to Work, competent and authorized representative as Health and Safety Co-ordinator. Health and Safety Co-ordinator must:

.1 Have site-related working experience specific to activities associated with designated substances.

.2 Have working knowledge of occupational safety and health regulations.

.3 Be responsible for completing Contractor's Health and Safety Training Sessions and ensuring that personnel not successfully completing required training are not permitted to enter site to perform Work.

.4 Be responsible for implementing, enforcing daily and monitoring site-specific Contractor's Health and Safety Plan.

.5 Be on site during execution of Work and report directly to and be under direction of site supervisor.

1.14 POSTING OF DOCUMENTS

.1 Ensure applicable items, articles, notices and 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.

1.14 POSTING OF DOCUMENTS (Cont'd)

.1 (Cont'd)
.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 Emeregency 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.

1.15 CORRECTION OF NON-COMPLIANCE

.1 Immediately address health and safety non-compliance issues identified by authority having jurisdiction or by Departmental Representative.

.2 Provide Departmental Representative with written report of action taken to correct non-compliance of health and safety issues identified.

.3 Departmental Representative may stop Work if non-compliance of health and safety regulations is not corrected.

1.16 BLASTING

.1 Blasting or other use of explosives is not permitted.

1.17 POWDER ACTUATED DEVICES

.1 Use powder actuated devices only after receipt of written permission from Departmental Representative.

1.18 WORK STOPPAGE

.1 Give precedence to safety and health of public and site personnel and protection of environment over cost and schedule considerations for Work.

.2 Assign responsibility and obligation to Health and Safety Coordinator or Competent Supervisor to stop or start Work when, at Health and Safety Coordinator's or Competent Supervisor's discretion, it is necessary or advisable for reasons of health or safety.

1.18 WORK STOPPAGE (Cont'd)

.2 (Cont'd)
Departmental Representative may also stop Work for health and safety considerations.

.3 No live work on electrical panels 120/208/347/600 Volts will be permitted on Project site. A shut down procedure needs to be followed for Lockout and tag out. If found working on live panels, work will be stopped immediately and Contractor will be removed from the site. Repeated offenders will be denied access to facility.

PART 2 - PRODUCTS

2.1 NOT USED

.1 Not used.

PART 3 - EXECUTION

3.1 NOT USED

.1 Not used.

END

PART 1 - GENERAL

1.1 REFERENCES

.1 Definitions:
.1 Environmental Pollution and Damage: presence of chemical, physical, biological elements or agents which adversely affect human health and welfare; unfavourably alter ecological balances of importance to human life; affect other species of importance to humans; or degrade environment aesthetically, culturally and/or historically.
.2 Environmental Protection: prevention/control of pollution and habitat or environment disruption during construction.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00.

.2 Before commencing construction activities or delivery of materials to site, submit Environmental Protection Plan for review and approval by Departmental Representative.

.3 Environmental Protection Plan must include comprehensive overview of known or potential environmental issues to be addressed during construction.

.4 Address topics at level of detail commensurate with environmental issue and required construction tasks.

.5 Include in Environmental Protection Plan:
.1 Names of persons responsible for ensuring adherence to Environmental Protection Plan.
.2 Names and qualifications of persons responsible for manifesting hazardous waste to be removed from site.
.3 Names and qualifications of persons responsible for training site personnel.
.4 Descriptions of environmental protection personnel training program.
.5 Drawings indicating locations of proposed material storage areas, and stockpiles of excess or spoil materials including methods to control runoff and to contain materials on site.
.6 Traffic Control Plans including measures to reduce erosion of temporary roadbeds by

1.2 ACTION AND INFORMATIONAL SUBMITTALS (Cont'd)

.5 (Cont'd)

.6 (Cont'd)

construction traffic, especially during wet weather.

.1 Plans to include measures to minimize amount of material transported onto paved public roads by vehicles or runoff.

.7 Work area plan showing proposed activity in each portion of area and identifying areas of limited use or non-use.

.1 Plan to include measures for marking limits of use areas and methods for protection of features to be preserved within authorized work areas.

.8 Spill Control Plan to include procedures, instructions, and reports to be used in event of unforeseen spill of regulated substance.

.9 Non-Hazardous solid waste disposal plan identifying methods and locations for solid waste disposal including clearing debris.

.10 Air pollution control plan detailing provisions to assure that dust, debris, materials, and trash, are contained on project site.

.11 Contaminant Prevention Plan identifying potentially hazardous substances to be used on job site; intended actions to prevent introduction of such materials into air, water, or ground; and detailing provisions for compliance with Federal, Provincial, and Municipal laws and regulations for storage and handling of these materials.

.12 Waste Water Management Plan identifying methods and procedures for management and or discharge of waste waters which are directly derived from construction activities, such as clean-up water, disinfection water, and water used in flushing of lines.

.13 Historical, archaeological, cultural resources biological resources plan that defines procedures for identifying and protecting historical, archaeological, cultural resources, and biological resources.

.14 Pesticide treatment plan to be included and updated, as required.

1.3 FIRES

.1 Fires and burning of rubbish on site is not permitted.

1.4 POLLUTION CONTROL

.1 Maintain temporary pollution control features installed under this Contract.

.2 Control emissions from equipment and plant in accordance with local authorities' emission requirements.

.3 Prevent sandblasting and other extraneous materials from contaminating air and waterways beyond application area.
.1 Provide temporary enclosures where directed by Departmental Representative.

.4 Cover or wet down dry materials and rubbish to prevent blowing dust and debris. Provide dust control for temporary roads.

1.5 HISTORICAL/ a ARCHAEOLOGICAL CONTROL

.1 Provide historical, archaeological, cultural resources, and biological resources plan that defines procedures for identifying and protecting historical, archaeological, cultural resources, and biological resources known to be on project site: and identifies procedures to be followed if historical archaeological, cultural resources, and biological resources not previously known to be onsite or in area are discovered during construction.

.2 Plan: include methods to assure protection of known or discovered resources and identify lines of communication between Contractor personnel and Departmental Representative.

1.6 NOTIFICATION

.1 Departmental Representative will notify Contractor in writing of observed noncompliance with Federal, Provincial or Municipal environmental laws or regulations, permits, and other elements of Contractor's Environmental Protection plan.

.2 Contractor: after receipt of such notice, inform Departmental Representative of proposed corrective action and take such action for approval by Departmental Representative.
.1 Take action only after receipt of written approval by Departmental Representative.

1.6 NOTIFICATION (Cont'd)

.3 Departmental Representative will issue stop order of work until satisfactory corrective action has been taken.

.4 No time extensions granted or equitable adjustments allowed to Contractor for such suspensions.

PART 2 - PRODUCTS

2.1 NOT USED

.1 Not Used.

PART 3 - EXECUTION

3.1 CLEANING

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

.2 Ensure public waterways, storm and sanitary sewers remain free of waste and volatile materials disposal.

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

.4 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 20.
.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END

PART 1 - GENERAL

1.1 REFERENCES AND CODES

.1 Perform Work in accordance with National Building Code of Canada (NBC) 2010, National Fire Code of Canada (NFC) 2010 and Ontario Building Code (OBC) 2006, including all amendments up to bid closing date and other codes of provincial or local application provided that in case of conflict or discrepancy, more stringent requirements apply.

.2 Meet or exceed requirements of:
.1 Contract documents.
.2 Specified standards, codes and referenced documents.

1.2 HAZARDOUS MATERIAL DISCOVERY

.1 Stop work immediately and notify Departmental Representative if materials which may contain designated substances or PCB's, other than those identified in Section 01 35 29 are discovered in course of work.

1.6 IAQ - INDOOR AIR QUALITY

.1 Comply with CSA-Z204-94(R1999), Guideline for Managing Indoor Air Quality in Office Buildings.

1.7 ACCESSIBLE DESIGN

.1 Comply with CSA B651-12, Accessible Design for the Built Environment, unless specified otherwise. In any case of conflict or discrepancy between the building codes and CSA B651, the requirements of CSA B651 shall apply.

1.9 TAXES

.1 Pay applicable Federal, Provincial and Municipal taxes.

1.10 EXAMINATION

.1 Examine existing conditions and determine conditions affecting work.

PART 2 - PRODUCTS

2.1 NOT USED .1 Not Used.

PART 3 - EXECUTION

3.1 NOT USED .1 Not Used.

END

PART 1 - GENERAL

1.1 ABBREVIATIONS AND ACRONYMS

.1 The abbreviations and acronyms are commonly found in the Project Manual and represent the associated organizations or terms.

1.2 MATERIALS, EQUIPMENT AND METHODS

.1 A:
- .1 AC: acoustic.
- .2 AC PAN: acoustic panel.
- .3 ACU: acoustic unit ceiling.
- .4 AFF: above finished floor.
- .5 AC PLAS: acoustic plaster.
- .6 ACT: acoustic tile.
- .7 ACR CU LVR: acrylic cube louvre.
- .8 ADH: adhesive.
- .9 ADJ: adjustable.
- .10 A/C: air conditioner.
- .11 AL: aluminum.
- .12 AB: anchor bolt.
- .13 ANOD: anodized.
- .14 ARCH: architecture.
- .15 ARCH BLK: architectural block.
- .16 AVB: air vapour barrier.

.2 B:
- .1 B: base.
- .2 BEAST: benthic assessment of sediment.
- .3 BH: bore hole.
- .4 BL: bottom layer.
- .5 BLK: block.
- .6 BLKD: bulkhead.
- .7 BM: beam.
- .8 BOT: bottom.
- .9 BMP: best management practice.
- .10 B PL: base plate.
- .11 BRG: bearing.
- .12 BRK: brick.
- .13 BSMT: basement.
- .14 BTEX: benzene, toluene, ethylbenzene and xylenes.
- .15 BUR: built-up roof.

.3 C:
- .1 CAL: caliper.
- .2 CANTIL: cantilever.
- .3 CB: catch basin.
- .4 CC: centre to centre.
- .5 CCN: contemplated change notice.
- .6 CDF: controlled density fill.
- .7 CEC: Canadian Electical Code.
- .8 CF: chair fabric.

1.2 MATERIALS, EQUIPMENT AND METHODS (Cont'd)

.3 C:(Cont'd)

.9 CHAN: channel.
.10 CHS: Canadian hydrographic service.
.11 CJ: construction joint.
.12 CL: centreline.
.13 CK: cork.
.14 CLG: ceiling.
.15 CLR: clear.
.16 COL: column.
.17 CONC: concrete.
.18 CONC BLK: concrete block.
.19 CONC BRK: concrete brick.
.20 CONT: continuous.
.21 CONT J: control joint.
.22 COMPL: complete.
.23 CM: centimetre. (Nursery stock).
.24 CPL: cement plaster.
.25 CPM: critical path method.
.26 CPT: carpet.
.27 CPTT: carpet tile.
.28 CT: ceramic tile.
.29 CVT: conductive vinyl tile.
.30 C/W: complete with.

.4 D:

.1 D: deep.
.2 DD: dutch door.
.3 DEG: degree.
.4 DF: drinking fountain.
.5 DIA: diameter.
.6 DIM: dimension.
.7 DL: dead load.
.8 DMNT: demountable.
.9 DP: dampproofing.
.10 DR: door.
.11 DRP: drapery.
.12 DWL: dowel.

.5 E:

.1 EA: each.
.2 EC: epoxy coating.
.3 ECF: engineered containment facility.
.4 EE: each end.
.5 EF: each face.
.6 EL: elevation.
.7 ELEC: electric.
.8 ELEV: elevator.
.9 EM: expanded metal.
.10 ENCL: enclosure.
.11 EQ: equal.
.12 EXH: exhaust.
.13 EXIST: existing.
.14 EXPJ: expansion joint.
.15 EXP STRUCT: exposed structure.
.16 EXT: exterior.

1.2 MATERIALS, EQUIPMENT AND METHODS (Cont'd)

.5 E:(Cont'd)
- .17 EW: each way.

.6 F:
- .1 FC: fuel contributed.
- .2 FD: floor drain.
- .3 FDN: foundation.
- .4 FEAT W: feature wall.
- .5 FEXT: fire extinguisher.
- .6 FH: fire hose.
- .7 FHC: fire hose cabinet.
- .8 FHR: fire hose rack.
- .9 FIN: finish.
- .10 FIP: federal identity program.
- .11 FL: floor.
- .12 FLD: field.
- .13 FLUOR: fluorescent.
- .14 FR: frame.
- .15 FRG: fire rated glass.
- .16 FRR: fire resistance rating.
- .17 FTG: footing.

.7 G:
- .1 GALV: galvanized steel.
- .2 GB: grab bar.
- .3 GBD: gypsum board.
- .4 GC: General Conditions.
- .5 GF: ground floor.
- .6 GFCI: ground fault circuit interrupter.
- .7 GL: glass or glazing.
- .8 GL BLK: glass block.
- .9 GPC: gypsum plaster ceiling.
- .10 GPW: gypsum plaster wall.
- .11 GT: glass tile.

.8 H:
- .1 HB: hose bib.
- .2 HC: hollow core.
- .3 HCWD: hollow core wood door.
- .4 HD: hand dryer.
- .5 HDW: hardware.
- .6 HDWD: hardwood.
- .7 HM: hollow metal.
- .8 HOR: horizontal.
- .9 HOR EF: horizontal each face.
- .10 HP: hydro pole.
- .11 HPA: Hamilton Port Authority.
- .12 HR: hour.
- .13 HRV: heat recovery ventilator.
- .14 HT: height.
- .15 HTR: heater.
- .16 HWT: hot water tank.
- .17 HYD: hydrant.

1.2 MATERIALS, EQUIPMENT AND METHODS (Cont'd)

.9 I:
- .1 ICF: insulated concrete formwork.
- .2 ID: inside diameter.
- .3 INS: insulation.
- .4 INTLK: interlock.

.10 J:
- .1 JT: joint.

.11 K:
- .1 KPL: kick plate.

.12 L:
- .1 LAV: lavatory.
- .2 LDG: landing.
- .3 LG: long.
- .4 LINO: linoleum.
- .5 LL: live load.
- .6 LT: light.

.13 M:
- .1 MAS: masonry.
- .2 MAS FL: masonry flashing.
- .3 MAX: maximum.
- .4 MBG: metal bar grating.
- .5 MCL: metal cube louvre.
- .6 MECH: mechanical.
- .7 MET: metal.
- .8 MET DK: metal deck.
- .9 MET FL: metal flashing.
- .10 MET GRID CLG: metal grid ceiling.
- .11 MET GRTG: metal grating.
- .12 MET LIN CLG: metal linear ceiling.
- .13 MET T PTN: metal toilet partition.
- .14 MH: maintenance hole.
- .15 MIN: minimum.
- .16 MLP: metal lath and plaster.
- .17 MO: masonry opening.
- .18 MR: marble.
- .19 MT: metal threshold.
- .20 MWP: membrane waterproofing.

.14 N:
- .1 NBC: national building code.
- .2 NF: near face.
- .3 NFC: national fire code.
- .4 NIC: not in contract.
- .5 NO: number.
- .6 NRC: noise reduction coefficient.
- .7 NRP: non removable pin.
- .8 NTS: not to scale.

.15 O:
- .1 OBC: Ontario building code.
- .2 OC: on centre.

1.2 MATERIALS, EQUIPMENT AND METHODS (Cont'd)

.15 O:(Cont'd)
- .3 OD: outside diameter.
- .4 OPNG: opening.
- .5 OPR: operator.
- .6 OVHD: overhead.
- .7 OWSJ: open web steel joist.

.16 P:
- .1 P: prefinished.
- .2 PAH: polynuclear aromatic hydrocarbons.
- .3 PARG: parging.
- .4 PCC: precast concrete.
- .5 PCT: porcelain ceramic tile.
- .6 PED ACS FLG: pedestal access flooring.
- .7 PF: panel fabric.
- .8 PL: plate.
- .9 PLAM: plastic laminate.
- .10 PLAS: plaster.
- .11 PLYWD: plywood.
- .12 PR: pair.
- .13 PREFAB: prefabricated.
- .14 PREFIN: prefinished.
- .15 PRFL: profile.
- .16 PT: paint.
- .17 PTD: paper towel dispenser.
- .18 PTN: partition.
- .19 PVC: polyvinyl cholide.

.17 Q:
- .1 QTB: quarry tile base.
- .2 QTF: quarry tile floor.
- .3 QTR: quarry tile roof.

.18 R:
- .1 R: radius.
- .2 RA: return air.
- .3 RB: resilient base.
- .4 RC: reinforced concrete.
- .5 RCPT: receptacle.
- .6 RD: roof drain.
- .7 REINF: reinforced/reinforcing.
- .8 REQD: required.
- .9 REQT: requirement.
- .10 RFT: rubber floor tile.
- .11 RM: room.
- .12 RO: rough opening.
- .13 RP: radiant panel.
- .14 RRS: recycled rubber sheet.
- .15 RRT: recycled rubber tile.
- .16 RSD: rolling steel door.
- .17 RSF: rubber sheet flooring.
- .18 RTU: roof top unit.
- .19 RWL: rain water leader.

1.2 MATERIALS, EQUIPMENT AND METHODS (Cont'd)

.19 S:
- .1 SAN SEW: sanitary sewer.
- .2 SCHED: schedule.
- .3 SC: solic core.
- .4 SCRN: screen.
- .5 SCWD: solid core wood door.
- .6 SD: smoke developed.
- .7 SDT: static dissipative tile.
- .8 SECT: section.
- .9 SH: sill height.
- .10 SIM: similar.
- .11 SL: sliding.
- .12 SLR: sealer.
- .13 SPEC: specification.
- .14 SS: stainless steel.
- .15 SSU: solid surfacing.
- .16 STD: standard.
- .17 STL: steel.
- .18 STL BM: steel beam.
- .19 STC: sound tranmission class.
- .20 STL FL DK: steel floor deck.
- .21 STL PL: steel plate.
- .22 STN: stone.
- .23 STR: structure or structural.
- .24 ST SEW: storm sewer.
- .25 S&U: stain and urethane.
- .26 S&V: stain and varnish.
- .27 SVT: solid vinyl tile.

.20 T:
- .1 T: top.
- .2 T&B: top and bottom.
- .3 TCB: turbidity control plan.
- .4 TEL: telephone.
- .5 TER: terrazzo.
- .6 TERT: terrazzo tile.
- .7 TGL: tempered glass.
- .8 THKNS: thickness.
- .9 THR: threshold.
- .10 TMPD: tempered.
- .11 TOPG: topping.
- .12 TRANSV: transverse.
- .13 TYP: typical.

.21 U:
- .1 U: urethane.
- .2 UCUT: undercut.
- .3 UGRD: underground.
- .4 UNO: unless noted otherwise.
- .5 UOS: unless otherwise specified.
- .6 U/S: underside.
- .7 UR: urinal.

1.2 MATERIALS, EQUIPMENT AND METHODS (Cont'd)

.22 V:
.1 VCF: vinyl coated fabric.
.2 VCT: vinyl compositition tile.
.3 VERT: vertical.
.4 VERT B: vertical blinds.
.5 VERT EF: vertical each face.
.6 VFGB: vinyl faced gypsum board.
.7 VSF: vinyl sheet flooring.
.8 VT: vinyl tile.
.9 VWC: vinyl wall covering.

.23 W:
.1 WC: water closet.
.2 W-C: wall connectors.
.3 WD: wood.
.4 WDV: wood veneer.
.5 WH: wall hydrant.
.6 WHMIS: workplace hazardous materials information system.
.7 WP: waterproofing.
.8 WR: washroom.
.9 WSIB: workplace safety and insurnace board.
.10 WT: weight.
.11 WTP: water treatment plant.

1.3 STANDARDS ORGANIZATIONS

.1 Standards writing organizations:
.1 AA - Aluminum Association.
.2 ACPA - American Concrete Pipe Association.
.3 ANSI - American National Standards Institute.
.4 ASHRAE - American Society of Heating and Refrigerating and Air-Conditioning Engineers.
.5 ASTM - American Society for Testing and Materials.
.6 AWI/AWMAC - Architectural Woodwork Institute/Architectural Woodwork Manufacturers Association of Canada.
.7 AWPA - American Wood Preservers' Association.
.8 AWWA - American Water Works Association.
.9 BHMA - Builders Hardware Manufacturers Association.
.10 CCDC - Canadian Construction Documents Committee.
.11 CCMPA - Canadian Concrete Masonry Producers Association.
.12 CGSB - Canadian General Standards Board.
.13 CNTA - Canadian Nursery Trades Association.
.14 CPCA - Canadian Painting Contractors Association.

1.3 STANDARDS ORGANIZATIONS (Cont'd)

.1 (Cont'd)

.15 CRCA - Canadian Roofing Contractors Association.

.16 CSA - Canadian Standards Association.

.17 CSC - Construction Specifications Canada.

.18 CSDMA - Canadian Steel Door Manufacturers Association.

.19 CSI - Construction Specifications Institute.

.20 CSSBI - Canadian Sheet Steel Building Institute.

.21 CRCA - Canadian Roofing Contractors Association.

.22 DHI - Door and Hardware Insitute.

.23 EEMAC - Electrical and Electronic Manufacturer's Association of Canada.

.24 ESA - Electrical Safety Authority.

.25 FCC - Fire Commissioner of Canada.

.26 FSC - Forest Stewardship Council.

.27 GANA - Glass Association of North America.

.28 HMMA - Hollow Metal Manufacturers Association.

.29 IEEE - Institute of Electrical and Electronics Engineers Inc.

.30 ISO - International Organization for Standardization.

.31 IWFA - International Window Film Association.

.32 LEED - LEED Canada, Leadership in Energy and Environmental Design.

.33 MPI - Master Painters Insitute.

.34 NAAMM - National Association of Architectural Metal Manufacturers.

.35 NCPI - National Clay Pipe Institute.

.36 NEMA - National Electrical Manufacturers Association.

.37 NFPA - National Fire Protection Association.

.38 OPSD - Ontario Provincial Standard Drawings.

.39 OPSS - Ontario Provincial Standard Specifications.

.40 PPI - Plasctics Pipe Institute.

.41 SDI - Steel Door Intitute.

.42 SCAQMD - South Coast Air Quality Management District.

.43 TIA - Telecommunications Industry Association.

.44 TIAC - Thermal Insulation Association of Canada.

.45 TTMAC - Terrazzo Tile and Marble Association of Canada.

.46 UL - Underwriters Laboratories.

1.3 STANDARDS ORGANIZATIONS (Cont'd)

.1 (Cont'd)
.47 ULC - Underwriters Laboratories of Canada.
.48 US EPA - United States Environmental Protection Agency.
.49 WH - Warnock Hersey.

1.4 FEDERAL GOVERNMENT DEPARTMENTS AND AGENGIES

.1 Departments, agencies and crown corporations.

.1 CEAA - Canadian Environmental Assessment Agency.
.2 CSC - Correctional Service Canada.
.3 CRA - Canada Revenue Agency.
.4 DND - Department of National Defence.
.5 EC - Environment Canada.
.6 FHBRO - Federal Heritage Buildings Review Office.
.7 HC - Health Canada.
.8 HCD - Heritage Conservation Directorate.
.9 LC - Labour Canada.
.10 PC - Parks Canada.
.11 PWGSC - Public Works and Government Services Canada.
.12 RCMP - Royal Canadian Mounted Police.
.13 TBS - Treasury Board Secretariat.
.14 TC - Transport Canada.

1.5 PROVINCIAL GOVERNMENT DEPARTMENTS AND AGENGIES

.1 MOEE - Ontario Ministry of Environment and Energy.

.2 MOL - Ontario Ministry of Labour.

.3 MTO and MOT - Ontario Ministry of Transportation.

.4 TSSA - Technical Standards and Safety Authority.

1.6 INTERNATIONAL GOVERNMENT DEPARTMENTS AND AGENCIES

.1 DOHMH - New York City Department of Health and Mental Hygiene, USA.

.2 GSA - Government Services Administration, USA.

1.7 UNITS OF MEASURE METRIC

.1 The following abbreviations of units of measure are commonly found in the Project Manual:

.1 C: Celsius.
.2 cm: centimetre.
.3 kg: kilogram.
.4 kg/m^3: kilogram per cubic metre.
.5 kN: kilonewton.
.6 kPa: kilopascals.
.7 kw: kilowatts.
.8 l/s: litre per second.
.9 m: metre.
.10 m^3: cubic metre.
.11 mg/kg: milligrams per kilogram.
.12 mg/L: milligrams per litre.
.13 mm: millimetres.
.14 MPa: megapascal.
.15 NTU: nephelometric turbidity unit.
.16 ppm: parts per million.
.17 ug/L: micrograms per litre.
.18 ug/m^3: micrograms per cubic metre.

1.8 UNITS OF MEASURE IMPERIAL

.1 The following abbreviations of units of measure are commonly found in the Project Manual:

.1 F: Fahrenheit.
.2 ft: foot/feet.
.3 ga: guage.
.4 gpm: gallons per minute.
.5 in: inches.
.6 lbs: pounds.
.7 NTU: nephelometric turbidity unit.
.8 psi: pounds-force per square inch.
.9 ppm: parts per million.

PART 2 - PRODUCTS

2.1 NOT USED

.1 Not Used.

PART 3 - EXECUTION

3.1 NOT USED

.1 Not Used.

END

PART 1 - GENERAL

1.1 SECTION INCLUDES

.1 Inspection and testing, administrative and enforcement requirements.

.2 Tests and mix designs.

.3 Mock-ups.

.4 Mill tests.

.5 Equipment and system adjust and balance.

1.2 RELATED SECTIONS

.1 Section 01 91 00 - Commissioning - General Requirements.

1.3 INSPECTION

.1 Allow Departmental Representative access to Work. If part of Work is in preparation at locations other than Place of Work, allow access to such Work whenever it is in progress.

.2 Give timely notice requesting inspection if Work is designated for special tests, inspections or approvals by Departmental Representative instructions, or law of Place of Work.

.3 If Contractor covers or permits to be covered Work that has been designated for special tests, inspections or approvals before such is made, uncover such Work, have inspections or tests satisfactorily completed and make good such Work.

.4 Departmental Representative may order any part of Work to be examined if Work is suspected to be not in accordance with Contract Documents. If, upon examination such work is found not in accordance with Contract Documents, correct such Work and pay cost of examination and correction. If such Work is found in accordance with Contract Documents, Departmental Representative shall pay cost of examination and replacement.

1.4 INDEPENDENT INSPECTION AGENCIES

.1 Independent Inspection/Testing Agencies will be engaged by Departmental Representative for purpose of inspecting and/or testing portions of Work.

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

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

.4 If defects are revealed during inspection and/or testing, appointed agency will request additional inspection and/or testing to ascertain full degree of defect. Correct defect and irregularities as advised by Departmental Representative at no cost to Departmental Representative. Pay costs for retesting and reinspection.

1.5 ACCESS TO WORK

.1 Allow inspection/testing agencies access to Work, off site manufacturing and fabrication plants.

.2 Co-operate to provide reasonable facilities for such access.

1.6 PROCEDURES

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

.2 Submit samples and/or materials required for testing, as specifically requested in specifications. Submit with reasonable promptness and in an orderly sequence so as not to cause delay in Work.

.3 Provide labour and facilities to obtain and handle samples and materials on site. Provide sufficient space to store and cure test samples.

1.7 REJECTED WORK

.1 Remove defective Work, whether result of poor workmanship, use of defective products or damage and whether incorporated in Work or not, which has been rejected by Departmental Representative as failing to conform to

1.7 REJECTED WORK (Cont'd)

.1 (Cont'd)
Contract Documents. Replace or re-execute in accordance with Contract Documents.

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

.3 If in opinion of Departmental Representative it is not expedient to correct defective Work or Work not performed in accordance with Contract Documents, Departmental Representative may deduct from Contract Amount difference in value between Work performed and that called for by Contract Documents, amount of which shall be determined by Departmental Representative.

1.8 REPORTS

.1 Submit 4 copies of inspection and test reports to Departmental Representative.

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

1.9 TESTS AND MIX DESIGNS

.1 Furnish test results and mix designs as may be requested.

.2 The cost of tests and mix designs beyond those called for in Contract Documents or beyond those required by law of Place of Work shall be appraised by Departmental Representative and may be authorized as recoverable.

1.10 MOCK-UPS

.1 Prepare mock-ups for Work specifically requested in specifications. Include for Work of all Sections required to provide mock-ups.

.2 Construct in all locations acceptable to Departmental Representative.

.3 Prepare mock-ups for Departmental Representative's review with reasonable promptness and in an orderly sequence, so as not to cause any delay in Work.

.4 Failure to prepare mock-ups in ample time is not considered sufficient reason for an

1.10 MOCK-UPS (Cont'd)

.4 (Cont'd) extension of Contract Time and no claim for extension by reason of such default will be allowed.

.5 If requested, Departmental Representative will assist in preparing a schedule fixing dates for preparation.

.6 Mock-ups may remain as part of Work if acceptable to the Departmental Representative.

1.11 MILL TESTS

.1 Submit mill test certificates as required of specification Sections.

1.12 EQUIPMENT AND SYSTEMS

.1 Submit testing, adjusting and balancing reports for mechanical, electrical and building equipment systems.

.2 Submit Commissioning Documentation in accordance with Section 01 91 00.

PART 2 - PRODUCTS

2.1 NOT USED

.1 Not Used.

PART 3 - EXECUTION

3.1 NOT USED

.1 Not Used.

END

PART 1 - GENERAL

1.1 SECTION INCLUDES

.1 Temporary utilities.

1.2 RELATED SECTIONS

.1 Section 01 52 00 - Construction Facilities.

.2 Section 01 56 00 - Temporary Barriers and Enclosures.

1.3 SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00.

1.4 INSTALLATION AND REMOVAL

.1 Provide temporary utilities controls in order to execute work expeditiously.

.2 Remove from site all such work after use.

1.5 WATER SUPPLY

.1 Provide continuous supply of potable water for construction use.

.2 Arrange for connections with Owner and pay all costs for installation, maintenance and removal.

.3 Pay for utility charges at prevailing rates.

1.6 TEMPORARY HEATING AND VENTILATION

.1 The existing premised are heated. If required, provide additional temporary heating during the construction period, including attendance, maintenance and fuel.

.2 Construction heaters used inside building must be vented to outside or be non-flameless type. Solid fuel salamanders are not permitted.

.3 Provide temporary heat and ventilation in enclosed areas as required to:
.1 Facilitate progress of Work.
.2 Protect Work and products against dampness and cold.

1.6 TEMPORARY HEATING AND VENTILATION (Cont'd)

.3 (Cont'd)
.3 Prevent moisture condensation on surfaces.
.4 Provide ambient temperatures and humidity levels for storage, installation and curing of materials.
.5 Provide adequate ventilation to meet health regulations for safe working environment.

.4 Maintain temperatures of minimum 10°C in areas where construction is in progress.

.5 Ventilating:
.1 Prevent accumulations of dust, fumes, mists, vapours or gases in areas occupied during construction.
.2 Provide local exhaust ventilation to prevent harmful accumulation of hazardous substances into atmosphere of occupied areas.
.3 Dispose of exhaust materials in manner that will not result in harmful exposure to persons.
.4 Ventilate storage spaces containing hazardous or volatile materials.
.5 Ventilate temporary sanitary facilities.
.6 Continue operation of ventilation and exhaust system for time after cessation of work process to assure removal of harmful contaminants.

.6 Permanent heating system of building, may be used. Be responsible for damage to heating system if use is permitted.

.7 Owner will pay utility charges when temporary heat source is existing building equipment.

.8 Maintain strict supervision of operation of temporary heating and ventilating equipment to:
.1 Conform with applicable codes and standards.
.2 Enforce safe practices.
.3 Prevent abuse of services.
.4 Prevent damage to finishes.
.5 Vent direct-fired combustion units to outside.

.9 Be responsible for damage to Work due to failure in providing adequate heat and protection during construction.

1.7 TEMPORARY POWER AND LIGHT

.1 Provide and pay for temporary power during construction for temporary lighting and operating of power tools.

.2 Arrange for connection with Owner and pay all costs for installation, maintenance and removal.

.3 Temporary power for electric cranes and other equipment requiring in excess of above is responsibility of Contractor.

.4 Provide and maintain temporary lighting throughout project. Ensure level of illumination on all floors and stairs is not less than 162 lx.

.5 Connect to existing power supply in accordance with Canadian Electrical Code and provide meters and switching.

.6 Electrical power and lighting systems installed under this Contract may be used for construction requirements only with prior approval of Departmental Representative provided that guarantees are not affected. Make good damage to electrical system caused by use under this Contract. Replace lamps which have been used for more than 3 months.

1.8 TEMPORARY COMMUNICATION FACILITIES

.1 Provide and pay for temporary telephone, fax, data hook up, lines and equipment necessary for own use and use of Departmental Representative.

1.9 FIRE PROTECTION

.1 Provide and maintain temporary fire protection equipment during performance of Work required by insurance companies having jurisdiction and governing codes, regulations and bylaws.

.2 Burning rubbish and construction waste materials is not permitted on site.

PART 2 - PRODUCTS

2.1 NOT USED

.1 Not Used.

PART 3 - EXECUTION

3.1 TEMPORARY EROSION AND SEDIMENTATION CONTROL

.1 Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to requirements of authorities having jurisdiction.

.2 Inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established.

.3 Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

END

PART 1 - GENERAL

1.1 SECTION INCLUDES

.1 Construction aids.

.2 Parking.

.3 Project identification.

1.2 REFERENCES

.1 Canadian Standards Association (CSA International)
.1 CSA Z797-09, Code of practice for Access Scaffold.
.2 CAN/CSA-Z321-96(R2006), Signs and Symbols for the Occupational Environment, withdrawn but still available from CSA, CCOHS and Techstreet.

1.3 SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00.

1.4 INSTALLATION AND REMOVAL

.1 Prepare site plan indicating proposed location and dimensions of area to be fenced and used by Contractor, number of trailers to be used, avenues of ingress/egress to fenced area and details of fence installation.

.2 Identify areas which have to be gravelled to prevent tracking of mud.

.3 Indicate use of supplemental or other staging area.

.4 Provide construction facilities in order to execute work expeditiously.

.5 Remove from site all such work after use.

1.5 SCAFFOLDING

.1 Scaffolding in accordance with CSA Z797.

.2 Provide and maintain scaffolding, ramps, ladders, platforms, and temporary stairs as required for the Work.

1.6 HOISTING

.1 Provide, operate and maintain hoists/cranes required for moving of workers, materials and equipment. Make financial arrangements with Subcontractors for use thereof.

.2 Hoists/cranes shall be operated by qualified operator.

1.7 ELEVATORS

.1 Designated existing elevators may be used by construction personnel and for transporting of materials. Co-ordinate use with Departmental Representative.

.2 Provide protective coverings for finish surfaces of cars and entrances.

1.8 SITE STORAGE/LOADING

.1 Confine work and operations of employees to areas defined by Contract Documents. Do not unreasonably encumber premises with products.

.2 Do not load or permit to load any part of Work with a weight or force that will endanger the Work.

1.9 CONSTRUCTION PARKING

.1 Parking will be permitted on site provided it does not disrupt performance of Work.

.2 Provide and maintain adequate access to project site.

.3 Build and maintain temporary roads where indicated or directed by Departmental Representative and provide snow removal during period of Work.

.4 If authorized to use existing roads for access to project site, maintain such roads for duration of Contract and make good damage resulting from Contractors' use of roads.

.5 Clean construction runways and taxi areas where used by Contractor's equipment.

1.10 SECURITY

.1 Pay for responsible security personnel to guard site and contents of site after working hours and during holidays.

1.11 EQUIPMENT, TOOL AND MATERIALS STORAGE

.1 Provide and maintain, in a clean and orderly condition, lockable weatherproof sheds for storage of tools, equipment and materials.

.2 Locate materials not required to be stored in weatherproof sheds on site in a manner to cause least interference with work activities.

1.12 SANITARY FACILITIES

.1 Provide sanitary facilities for work force in accordance with governing regulations and ordinances.

.2 Post notices and take such precautions as required by local health authorities. Keep area and premises in sanitary condition.

1.13 CONSTRUCTION SIGNAGE

.1 Provide and erect, within three weeks of signing Contract, a project sign in a location designated by Departmental Representative.

.2 Construction sign of wood frame and plywood construction painted with exhibit lettering produced by a professional sign painter.

.3 No other signs or advertisements, other than warning signs, are permitted on site.

.4 Signs and notices for safety and instruction shall be in both official languages. Graphic symbols shall conform to CAN/CSA-Z321.

.5 Maintain approved signs and notices in good condition for duration of project, and dispose of off site on completion of project or earlier if directed by Departmental Representative.

.6 Maintain signs in good condition for the duration of the Contract.

1.14 PROTECTION AND MAINTENANCE OF TRAFFIC

.1 Provide access and temporary relocated roads as necessary to maintain traffic.

.2 Maintain and protect traffic on affected roads during construction period except as otherwise specifically directed by Departmental Representative.

1.14 PROTECTION AND MAINTENANCE OF TRAFFIC (Cont'd)

.3 Provide measures for protection and diversion of traffic, including provision of watch-persons and flag-persons, erection of barricades, placing of lights around and in front of equipment and work, and erection and maintenance of adequate warning, danger, and direction signs

.4 Protect travelling public from damage to person and property.

.5 Contractor's traffic on roads selected for hauling material to and from site to interfere as little as possible with public traffic.

.6 Verify adequacy of existing roads and allowable load limit on these roads. Contractor: responsible for repair of damage to roads caused by construction operations.

.7 Construct access and haul roads necessary.

.8 Haul roads: constructed with suitable grades and widths; sharp curves, blind corners, and dangerous cross traffic shall be avoided.

.9 Provide necessary lighting, signs, barricades, and distinctive markings for safe movement of traffic.

.10 Dust control: adequate to ensure safe operation at all times.

.11 Location, grade, width, and alignment of construction and hauling roads: subject to approval by Departmental Representative.

.12 Lighting: to assure full and clear visibility for full width of haul road and work areas during night work operations.

.13 Provide snow removal during period of Work.

.14 Remove, upon completion of work, haul roads designated by Departmental Representative.

1.15 CLEAN-UP

.1 Remove construction debris, waste materials, packaging material from work site daily.

.2 Clean dirt or mud tracked onto paved or surfaced roadways.

1.15 CLEAN-UP (Cont'd)

.3 Store materials resulting from demolition activities that are salvageable.

.4 Stack stored new or salvaged material.

PART 2 - PRODUCTS

2.1 NOT USED

.1 Not Used.

PART 3 - EXECUTION

3.1 NOT USED

.1 Not Used.

END

PART 1 - GENERAL

1.1 SECTION INCLUDES

.1 Barriers.

.2 Environmental Controls.

.3 Traffic Controls.

.4 Fire Routes.

1.2 RELATED SECTIONS

.1 Section 01 51 00 - Temporary Utilities.

.2 Section 01 52 00 - Construction Facilities.

1.3 REFERENCES

.1 Canadian General Standards Board (CGSB):
.1 CAN/CGSB-1.189-2000, Exterior Alkyd Primer for Wood.
.2 CAN/CGSB-1.59-97, Alkyd Exterior Gloss Enamel.

.2 Canadian Standards Association (CSA):
.1 CSA-O121-08, Douglas Fir Plywood.

1.4 INSTALLATION AND REMOVAL

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

.2 Remove from site all such work after use.

1.5 HOARDING

.1 Erect temporary site enclosures using 38 x 89 mm construction grade lumber framing at 600 mm o.c. and 1200 x 2400 x 13 mm exterior grade fir plywood to CSA-O121.

.2 Apply plywood panels vertically flush and butt jointed.

.3 Provide one lockable truck entrance gate directed and conforming to applicable traffic restrictions on adjacent streets. Equip gates with locks and keys.

.4 Erect and maintain pedestrian walkways,including roofs and side covers, complete with signs and electrical lighting as required by law.

1.5 HOARDING (Cont'd)

.5 Paint public side of site enclosure in selected colours with one coat primer to CAN/CGSB-1.189 and one coat exterior paint to CAN/CGSB-1.59. Maintain public side of enclosure in clean condition.

1.6 GUARD RAILS AND BARRICADES

.1 Provide secure, rigid guard rails and barricades as required for Work of this Project and as required for governing authorities.

1.7 DUST TIGHT SCREENS

.1 Provide dust tight screens 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.

1.8 ACCESS TO SITE

.1 Provide and maintain access roads, sidewalk crossings, ramps and construction runways as may be required for access to Work.

1.9 PUBLIC TRAFFIC FLOW

.1 Provide and maintain competent signal flag operators, traffic signals, barricades and flares, lights, or lanterns as required to perform Work and protect the public.

1.10 FIRE ROUTES

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

1.11 PROTECTION FOR OFF-SITE AND PUBLIC PROPERTY

.1 Protect surrounding private and public property from damage during performance of Work.

.2 Be responsible for damage incurred.

1.12 PROTECTION OF BUILDING FINISHES

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

.2 Provide necessary screens, covers, and hoardings.

.3 Confirm with Departmental Representative locations and installation schedule 3 days prior to installation.

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

PART 2 - PRODUCTS

2.1 NOT USED

.1 Not Used.

PART 3 - EXECUTION

3.1 NOT USED

.1 Not Used.

END

PART 1 - GENERAL

1.1 SECTION INCLUDES

.1 Product quality, availability, storage, handling, protection, and transportation.

.2 Manufacturer's instructions.

.3 Quality of Work, coordination and fastenings.

.4 Existing facilities.

1.2 RELATED SECTIONS

.1 Section 01 45 00 - Quality Control.

1.3 REFERENCES

.1 Within text of specifications, reference may be made to reference standards.

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

.3 If there is question as to whether any product or system is in conformance with applicable standards, Departmental Representative reserves right to have such products or systems tested to prove or disprove conformance.

.4 The cost for such testing will be born by Owner in event of conformance with Contract Documents or by Contractor in event of non-conformance.

.5 Conform to latest date of issue of referenced standards in effect on date of submission of Bids, except where specific date or issue is specifically noted.

1.4 QUALITY

.1 Products, materials, equipment and articles (referred to as products throughout specifications) incorporated in Work shall be new, not damaged or defective, and of best quality (compatible with specifications) for purpose intended. If requested, furnish evidence as to type, source and quality of Products provided.

1.4 QUALITY (Cont'd)

.2 Defective products, whenever identified prior to completion of Work, will be rejected, regardless of previous inspections. Inspection does not relieve responsibility, but is precaution against oversight or error. Remove and replace defective products at own expense and be responsible for delays and expenses caused by rejection.

.3 Should any dispute arise as to quality or fitness of products, decision rests strictly with Departmental Representative based upon requirements of Contract Documents.

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

.5 Permanent labels, trademarks and nameplates on products are not acceptable in prominent locations, except where required for operating instructions, or when located in mechanical or electrical rooms.

1.5 AVAILABILITY

.1 Immediately upon signing Contract, review product delivery requirements and anticipate foreseeable supply delays for any items. If delays in supply of products are foreseeable, notify Departmental Representative of such, in order that substitutions or other remedial action may be authorized in ample time to prevent delay in performance of Work.

.2 In event of failure to notify Departmental Representative at commencement of Work and should it subsequently appear that Work may be delayed for such reason, Departmental Representative reserves right to substitute more readily available products of similar character, at no increase in Contract Price or Contract Time.

1.6 METRIC SIZED MATERIALS

.1 SI metric units of measurement are used 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.

1.6 METRIC SIZED MATERIALS (Cont'd)

.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.

1.7 STORAGE, HANDLING AND PROTECTION

.1 Handle and store products in manner to prevent damage, adulteration, deterioration and soiling and in accordance with manufacturer's instructions when applicable.

.2 Store packaged or bundled products in original and undamaged condition with manufacturer's seal and labels intact. Do not remove from packaging or bundling until required in Work.

.3 Store products subject to damage from weather in weatherproof enclosures.

.4 Store cementitious products clear of earth or concrete floors, and away from walls.

.5 Keep sand, when used for grout or mortar materials, clean and dry. Store sand on wooden platforms and cover with waterproof tarpaulins during inclement weather.

.6 Store sheet materials, lumber and on flat, solid supports and keep clear of ground. Slope to shed moisture.

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

1.7 STORAGE, HANDLING AND PROTECTION (Cont'd)

.8 Remove and replace damaged products at own expense and to satisfaction of Departmental Representative.

.9 Touch-up damaged factory finished surfaces to Departmental Representative's satisfaction. Use touch-up materials to match original. Do not paint over name plates.

1.8 TRANSPORTATION

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

1.9 MANUFACTURER'S INSTRUCTIONS

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

.2 Notify Departmental Representative in writing, of conflicts between specifications and manufacturer's instructions, so that Departmental Representative may establish course of action.

.3 Improper installation or erection of products due to failure in complying with these requirements, authorizes Departmental Representative to require removal and re-installation at no increase in Contract Price or Contract Time.

1.10 QUALITY OF WORK

.1 Ensure Quality of Work is of highest standard, executed by workers experienced and skilled in respective duties for which they are employed. Immediately notify Departmental Representative if required Work is such as to make it impractical to produce required results.

.2 Do not employ anyone unskilled in their required duties. Departmental Representative reserves right to require dismissal from site, workers deemed incompetent or careless.

.3 Decisions as to standard or fitness of Quality of Work in cases of dispute rest solely with Departmental Representative, whose decision is final.

1.11 CO-ORDINATION

.1 Ensure cooperation of workers in laying out Work. Maintain efficient and continuous supervision.

.2 Be responsible for coordination and placement of openings, sleeves and accessories.

1.12 CONCEALMENT

.1 In finished areas, conceal pipes, ducts and wiring in floors, walls and ceilings, except where indicated otherwise.

.2 Before installation, inform Departmental Representative if there is interference. Install as directed by Departmental Representative.

1.13 REMEDIAL WORK

.1 Perform remedial work required to repair or replace parts or portions of Work identified as defective or unacceptable. Coordinate adjacent affected Work as required.

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

1.14 LOCATION OF FIXTURES

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

.2 Inform Departmental Representative of conflicting installation. Install as directed.

1.15 FASTENINGS

.1 Provide metal fastenings and accessories in same texture, colour and finish as adjacent materials, unless indicated otherwise.

.2 Prevent electrolytic action between dissimilar metals and materials.

.3 Use non-corrosive hot dip galvanized steel fasteners and anchors for securing exterior work, unless stainless steel or other material is specifically requested in affected specification Section.

1.15 FASTENINGS (Cont'd)

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

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

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

1.16 FASTENINGS - EQUIPMENT

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

.2 Use heavy hexagon heads, semi-finished unless

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

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

1.17 PROTECTION OF WORK IN PROGRESS

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

1.18 EXISTING UTILITIES

.1 When breaking into or connecting to existing services or utilities, execute Work at times directed by local governing authorities, with minimum of disturbance to Work, and/or building occupants and pedestrian and vehicular traffic.

.2 Protect, relocate or maintain existing active services. When services are encountered, cap off in manner approved by authority having jurisdiction. Stake and record location of capped service.

PART 2 - PRODUCTS

2.1 NOT USED .1 Not Used.

PART 3 - EXECUTION

3.1 NOT USED .1 Not Used.

END

PART 1 - GENERAL

1.1 SECTION INCLUDES

.1 Establishing of existing services.

1.2 EXISTING SERVICES

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

.2 Abandoned service lines to be removed, capped and sealed as required for Work of this Project and as directed by the Departmental Representative, under Work of Section 02 41 19.

1.3 LOCATION OF EQUIPMENT AND FIXTURES

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

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

.3 Inform Departmental Representative of impending installation and obtain approval for actual location.

.4 Submit field drawings to indicate relative position of various services and equipment when required by Departmental Representative.

1.4 RECORDS

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

PART 2 - PRODUCTS

2.1 NOT USED .1 Not Used.

PART 3 - EXECUTION

3.1 NOT USED .1 Not Used.

END

PART 1 - GENERAL

1.1 SUBMITTALS

.1 Submittals: in accordance with Section 01 33 00.

.2 Submit written request in advance of cutting or alteration which affects:
- .1 Structural integrity of elements of project.
- .2 Integrity of moisture-resistant elements.
- .3 Efficiency, maintenance, or safety of operational elements.
- .4 Visual qualities of sight-exposed elements.
- .5 Work of Owner or separate contractor.

.3 Include in request:
- .1 Identification of project.
- .2 Location and description of affected Work.
- .3 Statement on necessity for cutting or alteration.
- .4 Description of proposed Work, and products to be used.
- .5 Alternatives to cutting and patching.
- .6 Effect on Work of Owner or separate contractor.
- .7 Written permission of affected separate contractor.
- .8 Date and time work will be executed.

1.2 MATERIALS

.1 Required for original installation.

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

1.3 PREPARATION

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

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

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

1.3 PREPARATION (Cont'd)

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

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

1.4 EXECUTION

.1 Execute cutting, fitting, and patching to complete Work.

.2 Fit several parts together, to integrate with other Work.

.3 Uncover Work to install ill-timed Work.

.4 Remove and replace defective and non-conforming Work.

.6 Provide openings in non-structural elements of Work for penetrations of mechanical and electrical Work.

.7 Execute Work by methods to avoid damage to other Work, and which will provide proper surfaces to receive patching and finishing.

.8 Employ original installer to perform cutting and patching for moisture-resistant elements, and sight-exposed surfaces.

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

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

.11 Submit proposed materials, finishes and installation method for patching to Departmental Representative for approval, prior to patching.

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

.13 Fit Work to pipes, ducts, conduits, sleeves and other penetrations through surfaces.

1.4 EXECUTION (Cont'd)

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

.15 Conceal pipes, ducts and wiring in floor, wall and ceiling construction of finished areas except where indicated otherwise.

1.5 WASTE MANAGEMENT AND DISPOSAL

.1 Separate waste materials for reuse and recycling in accordance with Section 01 74 20.

PART 2 - PRODUCTS

2.1 NOT USED

.1 Not Used.

PART 3 - EXECUTION

3.1 NOT USED

.1 Not Used.

END

PART 1 - GENERAL

1.1 SECTION INCLUDES

.1 Progressive cleaning.

.2 Final cleaning.

1.2 PROJECT CLEANLINESS

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

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

.3 Clear snow and ice from access to building, bank/pile snow in designated areas only remove from site.

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

.5 Provide on-site containers for collection of waste materials and debris.

.6 Provide and use clearly marked separate bins for recycling. Refer to Section 01 74 20.

.7 Remove waste material and debris from site and deposit in waste container at end of each working day.

.8 Dispose of waste materials and debris off site.

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

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

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

1.2 PROJECT CLEANLINESS (Cont'd)

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

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

1.3 FINAL CLEANING

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

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

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

.4 Remove waste products and debris other than that caused by Owner or other Contractors.

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

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

.7 Clean and polish glass, hardware, wall tile, stainless steel, chrome, porcelain enamel, baked enamel, plastic laminate, and mechanical and electrical fixtures. Replace broken, scratched or disfigured glass.

.8 Remove stains, spots, marks and dirt from decorative work, electrical and mechanical fixtures, furniture fitments, walls, and floors.

.9 Clean lighting reflectors, lenses, and other lighting surfaces.

.10 HEPA vacuum clean and dust building interiors, behind grilles, louvres and screens.

1.3 FINAL CLEANING (Cont'd)

.11 Wax, seal, shampoo or prepare floor finishes, as recommended by manufacturer.

.12 Inspect finishes, fitments and equipment and ensure specified workmanship and operation.

.13 Broom clean and wash exterior walks, steps and surfaces; rake clean other surfaces of grounds, affected by Work of this Project.

.14 Remove dirt and other disfiguration from exterior surfaces affected by Work of this Project.

.16 Sweep and wash clean paved areas affected by Work of this Project.

.17 Clean equipment and fixtures to a sanitary condition; clean or replace filters of mechanical equipment.

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

.20 Remove snow and ice from access to building.

PART 2 - PRODUCTS

2.1 NOT USED

.1 Not Used.

PART 3 - EXECUTION

3.1 NOT USED

.1 Not Used.

END

PART 1 - GENERAL

1.1 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, compost, anaerobic digest or sell material for reuse except where indicated otherwise. On site sales are not permitted.

.2 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, recycled, composted or anaerobically digested.

.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.

1.2 WASTE PROCESSING SITES

.1 Province of: Ontario.
- .1 Ministry of Environment and Energy, 135 St. Clair Avenue West, Toronto, ON, M4V 1P5.
- .2 Telephone: 800-565-4923 or 416-323-4321.
- .3 Fax: 416-323-4682.

.2 Recycling Council of Ontario: 215 Spadina Avenue, #225, Toronto, ON, M5T 2C7.
- .1 Telephone: 416-657-2797
- .2 Fax: 416-960-8053

1.2 WASTE PROCESSING SITES (Cont'd)

.2 Recycling Council of Ontario:(Cont'd)

.3 Email: rco@rco.on.ca.

.4 Internet: http://www.rco.on.ca/.

PART 2 - PRODUCTS

2.1 NOT USED

.1 Not Used.

PART 3 - EXECUTION

3.1 CANADIAN GOVERNMENTAL DEPARTMENTS CHIEF RESPONSIBILITY FOR THE ENVIRONMENT

.1 Government Chief Responsibility for the Environment.

Province	Address	General Inquiries	Fax
Ontario	Ministry of Environment and Energy 135 St Clair Avenue West Toronto, ON M4V 1P5	(416) 323-4321 (800) 565-4923	(416) 323-4682
	Environment Canada Toronto, ON	(416) 734-4494	

END

PART 1 - GENERAL

1.1 INSPECTION AND DECLARATION

.1 Contractor's Inspection: Contractor and all Subcontractors shall conduct an inspection of Work, identify deficiencies and defects, and repair as required to conform to Contract Documents.
.1 Notify Departmental Representative in writing of satisfactory completion of Contractor's Inspection and that corrections have been made.
.2 Request Departmental Representative's Inspection.

.2 Departmental Representative's Inspection: Departmental Representative and Contractor will perform inspection of Work to identify obvious defects or deficiencies. Contractor to correct Work accordingly.

.3 Completion: submit written certificate that following have been performed:
.1 Work has been completed and inspected for compliance with Contract Documents.
.2 Defects have been corrected and deficiencies have been completed.
.3 Equipment and systems have been tested, adjusted and balanced and are fully operational.
.4 Certificates required by Fire Commissioner and Utility companies have been submitted.
.5 Operation of systems have been demonstrated to Owner's personnel.
.6 Work is complete and ready for final inspection.

.4 Final Inspection: when items noted above are completed, request final inspection of Work by Departmental Representative and Contractor. If Work is deemed incomplete by Departmental Representative, complete outstanding items and request reinspection.

1.2 CLEANING

.1 In accordance with Section 01 74 11.

.2 Remove waste and surplus materials, rubbish and construction facilities from the site in accordance with Section 01 74 20.

PART 2 - PRODUCTS

2.1 NOT USED .1 Not Used.

PART 3 - EXECUTION

3.1 NOT USED .1 Not Used.

END

PART 1 - GENERAL

1.1 SECTION INCLUDES

.1 As-built, samples, and specifications.

.2 Equipment and systems.

.3 Product data, materials and finishes, and related information.

.4 Operation and maintenance data.

.5 Spare parts, special tools and maintenance materials.

.6 Warranties and bonds.

.7 Final site survey.

1.2 RELATED SECTIONS

.1 Section 01 91 00 - Commissioning - General Requirements.

.2 Section 01 91 20 - Project Commissioning.

.3 Section 01 79 00 - Demonstration and Training.

1.3 SUBMISSION

.1 Prepare instructions and data using personnel experienced in maintenance and operation of described products.

.2 Copy will be returned after final inspection, with Departmental Representative's comments.

.3 Revise content of documents as required prior to final submittal.

.4 Two weeks prior to Substantial Performance of the Work, submit to the Departmental Representative, four final copies of maintenance manuals and commissioning documentation in English.

.5 Ensure spare parts, maintenance materials and special tools provided are new, undamaged or defective, and of same quality and manufacture as products provided in Work.

.6 If requested, furnish evidence as to type, source and quality of products provided.

1.3 SUBMISSION (Cont'd)

.7 Defective products will be rejected, regardless of previous inspections. Replace products at own expense.

.8 Pay costs of transportation.

1.4 FORMAT

.1 Organize data in the form of an instructional manual.

.2 Binders: vinyl, hard covered, 3 'D' ring, loose leaf 219 x 279 mm with spine and face pockets.

.3 When multiple binders are used, correlate data into related consistent groupings. Identify contents of each binder on spine.

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

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

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

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

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

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

1.5 CONTENTS - EACH VOLUME

.1 Table of Contents: provide title of project;
.1 date of submission; names,
.2 addresses, and telephone numbers of Contractor with name of responsible parties;
.3 schedule of products and systems, indexed to content of volume.

.2 For each product or system:
.1 list names, addresses and telephone numbers of subcontractors and suppliers,

1.5 CONTENTS - EACH VOLUME (Cont'd)

.2 For each product or system:(Cont'd)
.1 (Cont'd)
including local source of supplies and replacement parts.

.3 Product Data: mark each sheet to clearly identify specific products and component parts, and data applicable to installation; delete inapplicable information.

.4 Drawings: supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams.

.5 Typewritten Text: as required to supplement product data. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions specified in Section 01 45 00.

.6 Training: Refer to Section 01 79 00 and 01 91 00.

1.6 AS-BUILTS AND SAMPLES

.1 In addition to requirements in General Conditions, maintain at the site for Departmental Representative, one record copy of:
.1 Contract Drawings.
.2 Specifications.
.3 Amendments and addenda.
.4 Change Orders and other modifications to the Contract.
.5 Reviewed shop drawings, product data, and samples.
.6 Field test records.
.7 Inspection certificates.
.8 Manufacturer's certificates.

.2 Store record documents and samples in field office apart from documents used for construction. Provide files, racks, and secure storage.

.3 Label record documents and file in accordance with Section number listings in List of Contents of this Project Manual. Label each document "PROJECT RECORD" in neat, large, printed letters.

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

1.6 AS-BUILTS AND SAMPLES (Cont'd)

.5 Keep record documents and samples available for inspection by Departmental Representative.

.6 Turn one set, paper copy and electronic copy, of AS-BUILT drawings and specifications over to Departmental Representative on completion of work. Submit files on USB compatible with PWGSC encryption requirements or through email or alternate electronic file sharing service such as ftp, as directed by Departmental Representative.

.7 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".

1.7 RECORDING ACTUAL SITE CONDITIONS

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

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

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

.4 Contract Drawings and shop drawings: legibly mark each item to record actual construction, including:
.1 Measured depths of elements of foundation in relation to finish first floor datum.
.2 Measured locations of internal utilities and appurtenances, referenced to visible and accessible features of construction.
.3 Field changes of dimension and detail.
.4 Changes made by change orders.
.5 Details not on original Contract Drawings.
.6 References to related shop drawings and modifications.

.5 Specifications: legibly mark each item to record actual construction, including:
.1 Manufacturer, trade name, and catalogue number of each product actually installed, particularly optional items and substitute items.

1.7 RECORDING ACTUAL SITE CONDITIONS (Cont'd)

.5 Specifications:(Cont'd)

.2 Changes made by Amendments and change orders.

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

1.8 FINAL SURVEY

.1 Submit final site survey certificate in accordance with Section 01 71 00, certifying that elevations and locations of completed Work are in conformance, or non-conformance with Contract Documents.

1.9 EQUIPMENT AND SYSTEMS

.1 Each Item of Equipment and Each System: include description of unit or system, and component parts. Give function, normal operation characteristics, and limiting conditions. Include performance curves, with engineering data and tests, and complete nomenclature and commercial number of replaceable parts.

.2 Panel board circuit directories: provide electrical service characteristics, controls, and communications.

.3 Include installed colour coded wiring diagrams.

.4 Operating Procedures: include start-up, break-in, and routine normal operating instructions and sequences. Include regulation, control, stopping, shut-down, and emergency instructions. Include summer, winter, and any special operating instructions.

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

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

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

1.9 EQUIPMENT AND SYSTEMS (Cont'd)

.8 Include sequence of operation by controls manufacturer.

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

.10 Provide installed control diagrams by controls manufacturer.

.11 Provide Contractor's coordination drawings, with installed colour coded piping diagrams.

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

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

.14 Include test and balancing reports as specified in Section 01 45 00 and 01 91 00.

.15 Additional requirements: As specified in individual specification sections.

1.10 MATERIALS AND FINISHES

.1 Building Products, Applied Materials, and Finishes: include product data, with catalogue number, size, composition, and colour and texture designations.

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

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

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

1.11 SPARE PARTS

.1 Provide spare parts, in quantities specified in individual specification sections.

1.11 SPARE PARTS (Cont'd)

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

.3 Deliver to location as directed; place and store.

.4 Receive and catalogue all items. Submit inventory listing to Departmental Representative. Include approved listings in Maintenance Manual.

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

1.12 MAINTENANCE MATERIALS

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

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

.3 Deliver to location as directed; place and store.

.4 Receive and catalogue all items. Submit inventory listing to Departmental Representative. Include approved listings in Maintenance Manual.

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

1.13 SPECIAL TOOLS

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

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

.3 Deliver to location as directed; place and store.

.4 Receive and catalogue all items. Submit inventory listing to Departmental Representative. Include approved listings in Maintenance Manual.

1.14 STORAGE, HANDLING AND PROTECTION

.1 Store spare parts, maintenance materials, and special tools in manner to prevent damage or deterioration.

.2 Store in original and undamaged condition with manufacturer's seal and labels intact.

.3 Store components subject to damage from weather in weatherproof enclosures.

.4 Store paints and freezable materials in a heated and ventilated room.

.5 Remove and replace damaged products at own expense and to satisfaction of Departmental Representative.

1.15 WARRANTIES AND BONDS

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

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

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

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

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

.6 Co-execute submittals when required.

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

PART 2 - PRODUCTS

2.1 NOT USED .1 Not Used.

PART 3 - EXECUTION

3.1 NOT USED .1 Not Used.

END

PART 1 - GENERAL

1.1 SECTION INCLUDES

.1 Procedures for demonstration and instruction of equipment and systems to Owner's O&M personnel.

.2 O&M personnel includes property facility manager, building operators, maintenenace staff, security staff and technical specialists, as applicable.

1.2 DESCRIPTION

.1 Demonstrate operation and maintenance of equipment and systems to Departmental Representative's personnel two weeks prior to date of substantial performance.

.2 Departmental Representative will provide list of personnel to receive instructions, and will coordinate their attendance at agreed-upon times.

1.3 QUALITY CONTROL

.1 When specified in individual Sections, require manufacturer to provide authorized representative to demonstrate operation of equipment and systems, instruct Owner's personnel, and provide written report that demonstration and instructions have been completed.

.2 Submit training schedule of time and date for demonstration and training of each item of equipment and each system in accordance with the training plan four weeks prior to designated dates, for Departmental Representative's approval.

.3 Submit reports within one week after completion of demonstration, that demonstration and instructions have been satisfactorily completed.

.4 Report shall give time and date of each demonstration and training, with list of persons present.

1.4 CONDITIONS FOR DEMONSTRATIONS

.1 Equipment has been inspected and put into operation in accordance with appropriate Section.

.2 Testing, adjusting, and balancing has been performed in accordance with Section 01 91 00 and equipment and systems are fully operational.

.3 Provide copies of completed operation and maintenance manuals for use in demonstrations and instructions.

1.5 PREPARATION

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

.2 Verify that designated O&M personnel are present.

1.6 DEMONSTRATION AND INSTRUCTIONS

.1 Demonstrate start-up, operation, control, adjustment, trouble-shooting, servicing, and maintenance of each item of equipment at agreed upon times, at the designated location.

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

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

.4 Prepare and insert additional data in operations and maintenance manuals when the need for additional data becomes apparent during instructions.

.5 Refer to individual Sections for specific demonstration and training requirements.

PART 2 - PRODUCTS

2.1 NOT USED .1 Not Used.

PART 3 - EXECUTION

3.1 NOT USED .1 Not Used.

END

PART 1 - GENERAL

1.1 SECTION INCLUDES

.1 Includes general requirements for commissioning facilities and facility systems.

1.2 RELATED SECTIONS

.1 Section 01 79 00 - Demonstration and Training.

.2 Section 01 91 20 - Project Commissioning.

1.3 QUALITY ASSURANCE

.1 Provide System Commissioning Administrator under provisions specified in Section 01 91 20.

.2 Comply with applicable procedures and standards of the certification sponsoring association.

.3 Perform services under direction of supervisor qualified under certification requirements of sponsoring association.

1.4 REFERENCES

.1 Associated Air Balance Council (AABC): National Standards For Field Measurements and Instrumentation, Total Systems Balance, Air Distribution-Hydronics Systems, 2002.

.2 ASHRAE Guideline 1.1-2007, HVAC&R Technical Requirements for the Commissioning Process.

.3 ASHRAE Guideline 4-2008, Preparation of Operating and Maintenance Documentation for Building System.

.4 NEBB Procedural Standards for Building Systems Commissioning (1999).

.5 NETA Standard for Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems 2009.

1.5 SUBMITTALS

.1 Within 15 working days of Award of Contract, submit name of System Commissioning Administrator proposed to perform services who

1.5 SUBMITTALS (Cont'd)

.1 (Cont'd)
has managerial responsibilities for coordination of all commissioning activities.

.2 Submit documentation to confirm System Commissioning Administrator compliance with quality assurance provision.

.3 Submit 3 preliminary specimen copies of each type of startup checklist, product information and performance verification report forms proposed for use.

.4 Submit completed report forms within 3 days after completion of each testing to the Departmental Representative for review and verification.

.5 Fifteen days prior to Substantial Performance, submit 3 copies of final reports on applicable forms for functional performance verification.

.6 Submit post-commissioning reports of testing, adjusting, and balancing postponed due to seasonal, climatic, occupancy, or other reasons beyond Contractor's control, promptly after execution of those services.

.7 Submit all other commissioning documentation in accordance with Section 01 91 20.

1.6 REPORT FORMS

.1 System Commissioning Administrator shall make reports.

.2 Report forms shall include:
.1 Startup Checklists.
.2 Product Information (PI) Report forms.
.3 Performance Verification (PV) Report forms.

.3 Ensure each form bears signature of recorder, and that of supervisor of reporting organization.

.4 Submit signed form to Departmental Representative for review and approval. After approval, immediately submit form bearing Departmental Representative's signature to Departmental Representative.

1.6 REPORT FORMS (Cont'd)

.5 Identify each instrument used for testing, adjusting and balancing and its latest date of calibration.

1.7 CONTRACTOR'S RESPONSIBILITIES

.1 Prepare each system for testing and balancing.

.2 Cooperate with testing organization and provide access to equipment and systems.

.3 Provide personnel and operate systems at designated times, and under conditions required for proper testing, adjusting, and balancing.

.4 Notify testing organization and Departmental Representative 7 days prior to time project will be ready for testing, adjusting, and balancing.

.5 Accurately record data for each step.

.6 Report to Departmental Representative any deficiencies or defects noted during performance of services.

.7 Correct deficiencies identified in accordance with Departmental Representative's written instructions.

1.8 PREPARATION

.1 Provide instruments required for testing, adjusting, and balancing operations.

.2 Make instruments available to Departmental Representative to facilitate spot checks during testing and functional performance verification.

.3 Retain possession of instruments and remove at completion of services.

.4 Verify systems installation is complete and in continuous operation.

.5 Verify lighting is turned on when lighting is included in cooling load.

.6 Verify equipment such as computers, laboratory and electronic equipment are in full operation when these equipment are included in cooling load.

1.9 EXECUTION

.1 Test equipment, balance distribution systems, and adjust devices for HVAC systems.

1.10 SCHEDULE OF SYSTEMS REQUIRING TESTING, ADJUSTING, AND BALANCING SERVICES

.1 Refer to individual Sections for specific requirements for testing, adjusting and balancing services.

PART 2 - PRODUCTS

2.1 NOT USED

.1 Not Used.

PART 3 - EXECUTION

3.1 NOT USED

.1 Not Used.

END

PART 1 - GENERAL

1.1 SPECIAL WARNING

.1 This project requires a special enhanced commissioning. The General Contractor must read and fully understand the special requirements specified in this Section prior to bidding this project.

.2 One of the commissioning requirements is that the General Contractor must engage a qualified independent System Commissioning Administrator (SCA) to coordinate and organize all Pre-Commissioning Testing, Commissioning Testing, and O&M Training. The SCA must complete the Contractor's Commissioning Documentation as specified in this Section.

.3 A total of 4% of the construction price will be held back by PWGSC for unfinished commissioning work.

1.2 RELATED SECTIONS

.1 Section 01 91 00: Commissioning - General Requirements.

1.3 GENERAL

.1 The "Commissioning" for this project is defined as a planned program of activities which enhance quality management and information transfer that extends throughout all stages of project delivery.

.2 The commissioning activities shall include the standard activities and the enhanced activities which are traditionally not provided by the design and construction industry and which are defined in this document.

1.4 REFERENCE STANDARDS

.1 The most stringent requirements of the following commissioning standards and guidelines shall apply:
.1 Associated Air Balance Council (AABC): National Standards for Field Measurements and Instrumentation, Total Systems Balance, Air Distribution - Hydronics Systems, 2002.
.2 ASHRAE Guideline 1.1-2007, the HVAC Commissioning Process.

1.4 REFERENCE STANDARDS (Cont'd)

.1 (Cont'd)

.3 ASHRAE Guideline 4-2008, Preparation of Operating and Maintenance Documentation for Building System.

.4 NEBB Procedural Standards for Building Systems Commissioning (1999).

.5 NETA Standard for Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems 2009.

1.5 ROLES AND RESPONSIBILITIES

.1 The key members of the commissioning team include the Contractor, the Departmental Representative, and the PWGSC Commissioning Manager (or its representative).

.1 It is the Contractor's responsibility to engage a qualified independent System Commissioning Administrator (SCA) to represent the Contractor including the Sub-Contractors. The SCA shall be responsible for carrying out the Contractor's commissioning activities under the direction of the Departmental Representative.

.2 The PWGSC Commissioning Manager (or its representative) will be assisted by the Departmental Representative and other project team members for overview of the commissioning activities on behalf of the PWGSC Project Manager. The PWGSC Commissioning Manager is the Commissioning Authority for this project.

.2 The Contractor is responsible for the following standard commissioning activities and enhanced commissioning activities during project construction, commissioning and operation phases.

.1 Construction Phase:

.1 Engage a qualified independent System Commissioning Administrator as single point of contact for all matters relating to commissioning (enhanced activity).

.2 Conduct commissioning meetings and prepare minutes of meeting.

.3 Submit shop drawings (standard activity).

.4 Conduct equipment installation and startup tests, and submit test reports (standard activity).

.5 Perform TAB and submit TAB report (standard activity).

.6 Conduct System Startup Verification Testing and complete Startup Checklists and PI Report forms (enhanced activity).

1.5 ROLES AND RESPONSIBILITIES (Cont'd)

.2 (Cont'd)

.2 Commissioning Phase:

.1 Conduct commissioning meetings and prepare minutes of meeting.

.2 Conduct Functional Performance Testing and complete PV Report forms (enhanced activity).

.3 Demonstrate system operation (standard activity).

.4 Submit Maintenance Manuals (formerly called O&M Manuals) (standard activity).

.5 Submit "As-Built" drawings and specifications (standard activity).

.6 Conduct O&M training (standard activity).

.3 Operation Phase:

.1 Conduct commissioning meetings and prepare minutes of meeting.

.2 Conduct deferred Functional Performance Testing and complete PV Report forms (enhanced activity).

.3 Provide fine-tuning (standard activity).

.4 Provide specified inspection and maintenance services during warranty period (standard activity).

.3 The Departmental Representative will carry out the following commissioning activities related to the Contractor:

.1 Prepare Startup Checklists, PI and PV Report Forms and Functional Performance Test Forms (enhanced activity).

.2 Prepare Standard Operation Procedures (SOP) Manual (formerly called Systems Manual) (enhanced activity).

.3 Review and approve shop drawings (standard activity).

.4 Review and inspect installation, and prepare construction deficiencies report (standard activity).

.5 Review and approve TAB report (standard activity).

.6 Direct and approve System Startup Verification Testing (enhanced activity).

.7 Direct and approve Functional Performance Testing (enhanced activity).

.8 Review and approve Maintenance Manuals (standard activity).

.9 Review and approve "As-Built" drawings and specifications (standard activity).

.10 Update Standard Operating Procedures (SOP) Manual (enhanced activity).

.11 Review O&M training (standard activity).

1.5 ROLES AND RESPONSIBILITIES (Cont'd)

.3 (Cont'd)

.12 Prepare commissioning report (enhanced activity).

.13 Witness post-acceptance commissioning testing (enhanced activity).

.14 Direct and approve post-acceptance fine-tuning and review warranty services (standard activity).

.15 Update commissioning report (enhanced activity).

.4 The PWGSC Commissioning Manager (or its representative) will carry out the following commissioning activities related to the Contractor and the Departmental Representative:

.1 Review and approve the qualifications of the System Commissioning Administrator (SCA) submitted by the Contractor.

.2 Review and approve Startup Checklists, PI and PV Report Forms prepared by the Departmental Representative.

.3 Witness System Startup Verification Testing conducted by the Contractor and review test reports.

.4 Witness Functional Performance Testing conducted by the Contractor and review test reports.

.5 Review and approve O&M training conducted by the Contractor.

.6 Review commissioning documentation submitted by the Contractor and Departmental Representative.

.7 Review and approved commissioning report prepared by the Departmental Representative.

.8 Witness the post-acceptance commissioning testing conducted by the Contractor and review test reports.

.9 Review and approve updated commissioning report prepared by the Departmental Representative.

1.6 QUALIFICATIONS OF SYSTEM COMMISSIONING ADMINISTRATOR (SCA)

.1 The System Commissioning Administrator: a qualified independent System Commissioning Administrator (SCA) for scheduling, coordination and supervision of Contractor's commissioning activities during construction, acceptance, and post-acceptance stages. The System Commissioning Administrator shall provide Contractor's Commissioning Documentation.

1.6 QUALIFICATIONS OF SYSTEM COMMISSIONING ADMINISTRATOR (SCA) (Cont'd)

.2 Unless approved by the PWGSC Commissioning Manager, the System Commissioning Administrator shall be a NEBB qualified SCA in building systems commissioning. The Contractor shall hire and submit the name of SCA with documentation confirming qualifications within 15 working days of award of contract.

1.7 SCHEDULING

.1 Within 15 working days of contract award, the Contractor shall submit bar chart commissioning schedules indicating anticipated date of start, duration, and date of completion for the following key activities:
.1 Commissioning meetings.
.2 Shop drawings.
.3 Pre-startup installation inspections and tests.
.4 System and Equipment Startup and Verification.
.5 TAB.
.6 Functional Performance Test.
.7 Maintenance Manuals.
.8 "As-Built" drawings and specifications.
.9 O&M Training.
.10 O&M Training report.

.2 Bar chart commissioning schedule shall be prepared for each component, equipment, sub-system, system and integrated system to be commissioned as listed under paragraph 1.11.

.3 The Commissioning shall be carried out to meet the approved project schedule.

1.8 CONTRACTOR'S COMMISSIONING DOCUMENTATION

.1 The Contractor's Commissioning Documentation shall include the following:
.1 Commissioning Schedule.
.2 Minutes of Commissioning meetings.
.3 Shop drawings and product data.
.4 Installation inspection and test reports.
.5 TAB reports.
.6 Startup Checklists.
.7 Product Information (PI) Report forms.
.8 Performance Verification (PV) Report forms.
.9 "As-Built" drawings and specifications.
.10 Maintenance Manuals.
.11 O&M Training Schedule
.12 O&M Training Report.

1.9 PRE-COMMISSIONING TESTING - STARTUPS

.1 Requirements of Pre-commissioning Verification: range of checks and tests to determine that all components, equipment, systems, and interfaces between systems (eg., emergency, fire, and life safety) operate in accordance with contact documents. This includes all operating modes, interlocks, control responses, and specific responses to abnormal or emergency conditions. Verification of the proper operation of the control system also includes verifying the interface of the control system with the TAB criteria and the response of EMCS controllers and sensors. Also, the Departmental Representative shall select, at random, 10 percent of the reported TAB and EMCS data for verification, and a failure of selected items shall result in the rejection of the final TAB report or the report of system startup and testing.

.2 The Startup Checklists and PI Report forms shall be completed by the Contractor and verified by the Departmental Representative.

1.10 COMMISSIONING TESTING

.1 Commissioning Testing shall include System Operation Demonstration and Functional Performance Testing of all systems to be commissioned. Test each system independently and then in unison with integrated systems.

.2 Requirements of Functional Performance Testing (FPT): FPT shall determine if the systems are providing the required services in accordance with the finalized design intent. If FPT cannot be completed due to seasonal reasons, lack of occupancy, deficiencies beyond the scope of the mechanical work, or any other reason, this shall be noted along with an indication of when tests will be rescheduled. If any identified performance deficiencies need to be corrected, the tests shall be repeated after corrective work is carried out, and this process shall continue until acceptable performance is achieved.

.3 The PV Report forms shall be completed by the Contractor and verified by the Departmental Representative.

1.11 EXTENT OF COMMISSIONING

.1 Systems to be commissioned with the comprehensive commissioning to include:
- .1 Fire protection.
- .2 HVAC systems.
- .3 Power systems.
- .4 Fire alarm.
- .6 Lighting control.
- .7 Mobile storage shelving.

1.12 O&M TRAINING

.1 The Contractor shall provide qualified training instructors to conduct O&M training.

.2 Four weeks prior to commencement of O&M training, the Contractor shall submit training schedule with course outline, agenda and a copy of training manual in accordance with the training plan for review by the Departmental Representative and the PWGSC Commissioning Manager.

.3 Training shall include familiarization sessions, hands-on instruction, and classroom sessions.

.4 Classroom training shall include: review of Maintenance Manuals, Standard Operating Procedures (SOP) Manual, System Operational Procedures for all modes of operation, acceptable tolerances for system adjustments and procedures for dealing with abnormal and emergency situations.

1.13 UNFINISHED COMMISSIONING WORK

.1 Prior to the "Certificate of Substantial Performance" a total of 4% of the construction price will be held back by PWGSC Project Manager until the acceptable Functional Performance Testing, O&M Training, and commissioning documentation have been completed.

1.14 COMMISSIONING REPORT AND POST-ACCEPTANCE COMMISSIONING

.1 When the acceptable Functional Performance Testing, O&M Training, and commissioning documentation have been completed, the Departmental Representative shall prepare a commissioning report. The report will identify the completed functional performance tests, the deferred functional performance tests, construction deficiencies, design deficiencies, user's changes of requirement,

1.14 COMMISSIONING REPORT AND POST-ACCEPTANCE COMMISSIONING (Cont'd)

.1 (Cont'd)
and outstanding commissioning issues. The report will provide review comments on test results, O&M training and commissioning documentation, and will recommend follow-up actions to be taken during post-acceptance commissioning.

.2 The Project Manager will not issue the "Certificate of Substantial Performance" until the commissioning report with a recommendation of acceptance is submitted by the PWGSC Commissioning Manager.

1.15 ADDITIONAL COMMISSIONING REQUIREMENTS

.1 Refer to other specifications sections for additional commissioning requirements.

PART 2 - PRODUCTS

2.1 NOT USED

.1 Not Used.

PART 3 - EXECUTION

2.1 NOT USED

.1 Not Used.

END

PART 1 - GENERAL

1.1 SECTION INCLUDES

.1 Methods and procedures for deconstruction of structures and parts of structures.

1.2 REFERENCES

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

.2 Federal Legislation.
.1 Canadian Environmental Assessment Act (CEAA), 1992, c. 37.
.2 Canadian Environmental Protection Act (CEPA), 1999, c. 33.
.3 Transportation of Dangerous Goods Act (TDGA), 1992, c. 34.

1.3 DEFINITIONS

.1 Alternate Disposal: reuse and recycling of materials by designated facility, user or receiving organization which has valid Certificate of Approval to operate. Alternative to landfill disposal.

.2 Deconstruction: systematic dismantling of structure in a manner that achieves safe removal/disposal of hazardous materials and maximum salvage/recycling of materials.
.1 Ultimate objective is to recover potentially valuable resources while diverting from landfill what has traditionally been significant portion of waste system.

.3 Demolition: rapid destruction of structure with or without prior removal of hazardous materials.

.4 Hazardous Materials: dangerous substances, dangerous goods, hazardous commodities and hazardous products, including but not limited to: corrosive agents, flammable substances, ammunition, explosives, radioactive substances, or other material that can endanger human health, well being or environment if handled improperly.

.5 Recycle: process by which waste and recyclable materials are transformed or

1.3 DEFINITIONS (Cont'd)

.5 Recycle:(Cont'd) collected for purpose of being transferred into new products.

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

.7 Reuse: repeated use of product in same form but not necessarily for same purpose. Reuse includes:
.1 Salvaging reusable materials from remodelling projects, before demolition stage, for resale, reuse on current project or for storage for use on future projects.
.2 Returning reusable items including pallets or unused products to vendors.

.8 Salvage: removal of structural and non-structural materials from deconstruction/disassembly projects for purpose of reuse or recycling.

.9 Source Separation: acts of keeping different types of waste materials separate, beginning from first time they became waste.

.10 Waste Management Coordinator (WMC): contractor representative responsible for supervising waste management activities as well as coordinating related, required submittal and reporting requirements.

1.4 SUBMITTALS

.1 Submittals in accordance with Section 01 33 00.

.2 Submit pre-demolition audit and deconstruction/disassembly plan prior to starting work in accordance with Section 01 33 00.

.3 Submit copies of bills of lading from authorized disposal sites and reuse and recycling facilities for material removed from site to Departmental Representative upon request.
.1 Written authorization from Departmental Representative is required to deviate from facilities listed in Waste Reduction Workplan.

1.4 SUBMITTALS (Cont'd)

.4 Include following information:
.1 Time and date of removal.
.2 Description of materials.
.3 Quantity of material.
.4 Breakdown of reuse, recycling and landfill quantities.
.5 End destination of materials.

.5 Workers, haulers and subcontractors must possess current, applicable permits to remove, handle and dispose of wastes categorized Provincially as hazardous.
.1 Provide proof of compliance within 24 hours upon written request of Departmental Representative.

1.5 QUALITY ASSURANCE

.1 Ensure Work is performed in compliance with CEPA, CEAA, TDGA, and applicable provincial regulations.

1.6 STORAGE, HANDLING AND PROTECTION

.1 Do in accordance with Section 01 61 00.

1.7 ENVIRONMENTAL REQUIREMENTS

.1 Do Work in accordance with Section 01 35 43.

1.8 SITE CONDITIONS

.1 Existing Conditions.
.1 Should materials resembling spray or trowel applied asbestos or other designated substances be encountered in course of deconstruction, stop work, take preventative measures, and notify Departmental Representative immediately. Do not proceed until written instructions have been received.
.2 Label and package component parts of mechanical and electrical material specified for salvage as specified to prevent damage or loss.

.2 Protection.
.1 Prevent movement, settlement or damage of adjacent structures and services as required. Provide bracing as required. Repair damage caused by deconstruction as directed by Departmental Representative.

1.8 SITE CONDITIONS (Cont'd)

.2 (Cont'd)

.2 Support affected structures and, if safety of structure being deconstructed or adjacent structures or services appear to be endangered, take preventative measures. Cease operations and immediately notify Departmental Representative.

.3 Prevent debris from blocking surface drainage system, elevators, mechanical and electrical systems.

PART 2 - PRODUCTS

2.1 MATERIALS

.1 All materials requiring removal shall become the Contractor's property and shall be removed and disposed of from the site, as the work progresses, unless indicated otherwise.

.2 Salvaged material: Salvage and stockpile original materials as indicated on site or drawings. Salvaged materials shall not be chipped, cracked, split, stained or damaged. Store items off of moist surfaces.

2.2 EQUIPMENT

.1 Leave equipment and machinery running only while in use, except where extreme temperatures prohibit shutting down.

.2 Where possible, use water efficient wetting equipment/trucks/attachments when minimizing dust.

.3 Demonstrate that tools are being used in manner which allows for salvage of materials in best condition possible.

PART 3 - EXECUTION

3.1 SITE VERIFICATION OF CONDITIONS

.1 Determine if Environmental Assessment (EA) is required under requirements of CEAA.
.1 If necessary, employ licensed consultant to perform EA.
.2 Communicate findings and conclusions in writing to Departmental Representative prior to start of Work.

3.2 PREPARATION

.1 Disconnect and re-route electrical, telephone and communication service lines entering buildings to be deconstructed. Post warning signs on electrical lines and equipment which must remain energized to serve other products during period of demolition.

.2 Locate and protect utility lines. Do not disrupt active or energized utilities designated to remain undisturbed.

.3 Disconnect and cap designated mechanical services.
.1 Natural gas supply lines: remove in accordance with utility company requirements.
.2 Water lines: remove in accordance with requirements of authority having jurisdiction.

3.3 REMOVAL OF HAZARDOUS WASTES

.1 Prior to start of deconstruction work remove contaminated or hazardous materials as defined by authorities having jurisdiction and as directed by Departmental Representative from site and dispose of in safe manner in accordance with TDGA and other applicable regulatory requirements.

3.4 DEMOLITION, GENERAL

.1 Perform demolition with extreme care. Confine effects of demolition to those parts which are to be demolished.

.2 Perform Work and prevent inconvenience to persons outside those parts which are to be demolished.

.3 Carry out demolition in accordance with the requirements of CSA S350.

3.5 DISASSEMBLY AND REMOVAL

.1 Materials removed from designated structures are property of Contractor, unless otherwise indicated.

.2 Throughout course of deconstruction pay close attention to connections and material assemblies. Employ workmanship procedures which minimize damage to materials and equipment.

.3 Ensure workers and subcontractors are trained to carry out work in accordance with appropriate deconstruction techniques.

.4 Project supervisor with previous deconstruction experience must be present on site throughout project.

.5 Deconstruct in accordance with CSA S350 and other applicable safety standards.

.6 Workers must utilize adequate fall protection where Departmental Representative considers it necessary.

.7 Maintain structural integrity of structure.

.8 Systematically remove finishes, furnishings, and mechanical and electrical equipment as instructed by Departmental Representative.

.9 Carefully remove doors and frames from structure.

.10 Disassemble non-loadbearing interior partitions and remove materials from structure.

.11 Wherever possible, transfer material assemblies from heights to ground level for easier disassembly. Take appropriate measures to ensure safety.

.12 Separate from waste stream, material in condition suitable for reuse and/or recycling.

.13 Remove and store materials to be salvaged, in manner to prevent damage.
.1 Store and protect in accordance with requirements for maximum preservation of material.
.2 Handle salvaged materials as new materials.

3.5 DISASSEMBLY AND REMOVAL (Cont'd)

.14 Source separate for recycling materials that cannot be salvaged for reuse including wood, metal, concrete and asphalt.

.15 Remove materials that cannot be salvaged for reuse or recycling and dispose of in accordance with applicable codes at licensed facilities.

.16 Where existing materials are to be re-used in Work, use special care in removal, handling, storage and re-installation to assure proper function in completed work.

.17 Remove interior finishes, such as ceiling and floor finishes, where new finishes are indicated on Contract Drawings.
.1 Removal of existing ceilings shall include complete removal including bulkheads and suspension system.
.2 Removal of adhesive applied finishes shall include complete removal to substrate including adhesive. Take adequate care to prevent damage to substrate.
.3 Remove existing floor finishes, include mortar bed, underlayment or other cleavage membranes, underpad, base, floor moulding and transition strips.

3.6 PROCESSING

.1 Designate location for processing of materials which eliminates double handling and provides adequate space to maintain efficient material flow.

.2 Denail, strip,and separate materials to ensure best possible condition of salvaged materials.

.3 Keep processing area clean and free of excess debris.

.4 Supply separate, marked disposal bins for categories of waste material. Do not remove bins from site until inspected and approved by Departmental Representative. Notify Departmental Representative prior to removal of bins from site.

.5 Separate processed materials into organized piles for stockpiling. Provide collection area for materials processed and designated for alternate disposal. Pile materials on pallets

3.6 PROCESSING (Cont'd)

.5 (Cont'd)
to facilitate transport off-site or to storage areas.

3.7 STOCKPILING AND SALVAGED ITEMS

.1 Label stockpiles, indicating material type and quantity.

.2 Designate appropriate security resources/measures to prevent vandalism, damage and theft.

.3 Locate stockpiled materials convenient for use in new construction. Eliminate double handling wherever possible.

.4 Stockpile materials designated for alternate disposal in location which facilitates removal from site and examination by potential end markets, and which does not impede disassembly, processing, or hauling procedures.

.5 List and description of items to be removed and stored or reused:
.1 Doors, frames and hardware.
.2 Tables.
.3 Turnstiles and associated components.
.4 Re-use existing ceiling hangers for new ceiling assembly wherever possible. Coordinate with Section 09 51 23 as required.
.4 Any additional items as indicated on the Contract Drawings or by the Departmental Representative.

3.8 REMOVAL FROM SITE

.1 Transport material designated for alternate disposal by approved facilities listed in waste reduction workplan and in accordance with applicable regulations. Do not deviate from facilities listed in waste reduction workplan without prior written authorization from Departmental Representative.

.2 Dispose of materials not designated for alternate disposal in accordance with applicable regulations. Disposal facilities must be approved of and listed in waste reduction workplan. Do not deviate from disposal facilities listed in waste reduction workplan without prior written authorization from Departmental Representative.

3.9 CLEANING AND RESTORATION

.1 Keep site clean and organized throughout deconstruction.

.2 Upon completion of project, remove debris, trim surfaces and leave work site clean.

.3 Upon completion of project, reinstate areas affected by Work to condition which existed prior to beginning of Work.

END

PART 1 - GENERAL

1.1 REFERENCES

.1 American Architectural Manufacturers Association(AAMA):
.1 AAMA 2603-02, Voluntary Specification, Performance Requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels.

.2 American National Standards Institute (ANSI):
.1 ANSI H35.1/H35.1M-2009, Alloy and Temper Designation Systems for Aluminum (Metric).

.3 American Society for Testing and Materials International, (ASTM):
.1 ASTM B209-10, Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
.2 ASTM B211-12e1, Specification for Aluminum and Aluminum-Alloy Bar, Rod, and Wire.
.3 ASTM F593-13, Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs.

.4 Canadian Standards Association (CSA):
.1 CSA B651-12, Accessible Design for the Built Environment.
.2 CSA G40.20-04(2009)/G40.21-04(R2009), General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
.3 CAN/CSA S16-09, Design of Steel Structures.
.4 CSA S136-M-07(R2012), North American Specification for the Design of Cold-Formed Steel Structural Members.
.5 CAN/CSA-W59-03(R2008), Welded Steel Construction (Metal Arc Welding).

.5 Green Seal Environmental Standards (GS)
.1 GS-11-2011, 3rd Edition, Paints and Coatings.

.6 The Master Painters Institute (MPI) / Architectural Painting Specification Manual,latest edition.
.1 MPI #79 - Primer, Alkyd, Anti-Corrosive for Metal.

1.2 DESIGN REQUIREMENTS

.1 Design metal fabrications in accordance with CAN/CSA-B651.

.2 Design details and connections, where not shown on Drawings, in accordance with CAN/CSA-S16 and CSA S136.

.3 Design miscellaneous, additional structural framing members as required to complete the Work, where not indicated on Contract Drawings.

1.3 SUBMITTALS

.1 Submit shop drawings and product data of each item specified in accordance with Section 01 33 00.
.1 Indicate materials, core thicknesses, finishes, connections, joints, method of anchorage, number of anchors, supports, reinforcement, details and accessories.
.2 Indicate each item's conformance with CSA B651.
.3 Each shop drawing submission shall bear signature and stamp of qualified professional engineer registered or licensed in province of Ontario.

.2 Submit the following samples: .
.1 150 x 150 mm sample of metal demonstrating powder coat finish and colour for the Departmental Representative's approval.

1.4 QUALITY ASSURANCE

.1 Retain a Professional Engineer, licensed in the Province of Ontario, with experience in Work of comparable complexity and scope, to perform the following services as part of the Work of this Section:
.1 Design metal fabrication items that are required to resist live, dead, lateral, wind, or seismic loads.
.2 Review, stamp, and sign shop drawings.

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

.3 Certifications: submit product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

1.5 DELIVERY, STORAGE AND HANDLING

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

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

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

PART 2 - PRODUCTS

2.1 MATERIALS

.1 General:
.1 All materials under Work of this Section, including but not limited to, primers and paints are to have low VOC content limits.
.2 Wherever possible, metals used in work of this Section are to contain recycled content.
.3 Unless detailed or specified herein, standard products will be acceptable if construction details and installation meet intent of Drawings and Specifications.
.4 Include all materials, products, accessories, and supplementary parts necessary to complete assembly and installation of Work of this Section.
.5 Incorporate only metals that are free from defects which impair strength or durability, or which are visible. Install only new metals of best quality, and free from rust or waves and buckles, and that are clean, straight, and with sharp defined profiles.

.2 SS bolts, nuts and washers: stainless steel to ASTM F593, minimum 75% recycled content.

.3 Steel: to CSA G40.20/G40.21, Grade 300W, minimum 30% recycled content.

.4 Hollow Structural Sections (HSS): to CSA G40.20/G40.21, Grade 350W, Class H, minimum 30% recycled content.

2.1 MATERIALS (Cont'd)

.5 Aluminum extrusions and sheet:
.1 Aluminum extrusions and channels: Conforming to ASTM B211 and ANSI H35.1/H35.1M, Aluminum Association Designation AA6063-T5.
.2 Aluminum sheet: Conforming to ASTM B209 and ANSI H35.1/H35.1M, Designation AA1100, H14 temper, minimum 80% recycled content, minimum 1.29 mm for sheets less than 610 mm wide and minimum 2.05 mm for sheets of a greater dimension.
.3 Finish: Powder coat finish as specified in colour as selected by the Departmental Representative.

.6 Powder coating: Epoxy polyester powder coating conforming to AAMA 2603 in colour and texture as selected by the Departmental Representative.
.1 Provide samples for each colour and finish for the Departmental Representative's approval.
.2 Finishes shall be fully cured and inert at fabricator's shop.
.3 Provide manufacturer recommended primer.
.4 For use at aluminum reveals where shown on Contract Drawings.

.7 Alkyd primer: to MPI #79, E3 environmental rating.

.8 Grout: non-shrink, non-metallic, flowable, 24 h, 15 MPa, pullout strength 7.9 MPa.

.9 Construction adhesive: Low VOC construction adhesive recommended by metal fabricator and approved by the Departmental Representative. For use at metal base used at millwork areas as indicated.

2.2 FABRICATION

.1 Fit joints in true planes and securely fasten.

.2 Weld to CSA W59. File or grind welds smooth and flush with adjoining surface.

.3 Shop assemble work.

2.3 FINISHES

.1 Shop coat primer: In accordance with MPI code INT-5.1R and to meet VOC limits of GS-11.

2.3 FINISHES (Cont'd)

.2 Paint finish: In accordance with Section 09 91 23.

2.4 SHOP PAINTING

.1 Primer: VOC limit 250 g/L maximum to GS-11.

.2 Apply one shop coat of primer to metal items, with exception of galvanized or concrete encased items.

.3 Use primer unadulterated, as prepared by manufacturer. Paint on dry surfaces, free from rust, scale, grease. Do not paint when temperature is lower than 7 degrees C.

.4 Clean surfaces to be field welded; do not paint.

2.5 POWDER COATING

.1 Shop apply powder coating to items as indicated in accordance with manufacturer's instructions.

.2 Clean assemblies as indicated free of rust and grease. Pretreat with zinc phosphate. Spray apply powder coating electrostatically to a dry film thickness of 3 to 4 mils.

PART 3 - EXECUTION

3.1 EXAMINATION

.1 Verification of Conditions: verify conditions of substrates previously installed under other Sections or Contracts are acceptable for metal fabrications installation in accordance with manufacturer's written instructions.
.1 Visually inspect substrate in presence of Departmental Representative.
.2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 INSTALLATION

.1 Do welding work in accordance with CSA W59 unless specified otherwise.

.2 Erect metalwork square, plumb, straight, and true, accurately fitted, with tight joints and intersections.

.3 Supply other sections with templates, instructions and built-in items.

.4 Install work straight, plumb and level to a tolerance of 1:600.

.5 Coordinate with applicable Sections as required for Work of this Section.

.6 Provide suitable means of anchorage acceptable to Departmental Representative such as dowels, anchor clips, bar anchors, expansion bolts and shields, and toggles.

.7 Exposed fastening devices to match finish and be compatible with material through which they pass.

.8 Make field connections with bolts to CSA S16 or Weld field connection.

.9 Deliver items over for casting into concrete and building into masonry together with setting templates to appropriate location and construction personnel.

.10 Touch-up burnt, scratched or chipped primer.

3.3 LOOSE ANGLE LINTELS

.1 Supply steel loose angle lintels of sizes required to suit openings as a result of renovation work for this Project.

.2 Apply alkyd primer to interior lintels.

.3 Provide 150 mm bearing at ends, unless otherwise indicated.

.4 Weld or bolt together back-to-back angles.

3.4 MISCELLANEOUS BRACKETS, SUPPORTS, AND PLATES

.1 Supply and install or supply for installation by trades responsible, all loose brackets, supports, angles, and plates where indicated, except where such brackets, supports, angles and plates are specified under work of other Sections. Drill for countersunk screws, expansion anchors and anchor bolts. Provide adhesive anchors where required.

.2 Unless otherwise specified, prime paint for interior installation.

3.5 ALUMINUM REVEALS

.1 Aluminum reveals: Provide extruded aluminum reveals for millwork areas where shown on Contract Drawings. Coordinate with Section 06 40 01 as required for sizing and installation.

.2 Finish: Powder coat finish in colour as selected by the Departmental Representative.

3.6 CLEANING

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

.2 Upon completion remove surplus materials, rubbish, tools and equipment.

3.7 PROTECTION

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

.2 Repair damage to adjacent materials caused by metal fabrications installation.

END

PART 1 - GENERAL

1.1 REFERENCES

.1 American Wood Protection Association (AWPA):
.1 AWPA P8-11, Standard for Oil-Borne Preservatives.

.2 Canadian Standards Association (CSA):
.1 CSA O80 Series-08(R2012), Wood Preservation, Includes Update No. 1 (2008).
.2 CAN/CSA-O86-09 Consolidation, Engineering Design in Wood.
.3 CSA O112 Series M1977(R2006), CSA Standards for Wood Adhesives.
.4 CSA O121-08(R2013), Douglas Fir Plywood.

.3 National Building Code of Canada, NBC 2010.

.4 National Lumber Grades Authority Standard Grading Rules for Canadian Lumber, December 1, 2010:
.1 Special Product Standard SP-1-February 2013.
.2 Special Product Standard SP-2-February 2013.

.5 South Coast Air Quality Management District (SCAQMD):
.1 SCAQMD Rule 1168-05, Adhesive and Sealant Applications, Amended January 7, 2005.

1.2 QUALITY ASSURANCE

.1 Lumber by grade stamp of an agency certified by Canadian Lumber Standards Accreditation Board.

.2 Plywood in accordance with CSA and ANSI standards.

PART 2 - PRODUCTS

2.1 MATERIALS

.1 Wood: S-DRY, graded and stamped to National Lumber Grades Authority, Standard Grading Rules for Canadian Lumber, S4S.
.1 Studs: spruce, pine or fir (SPF), 121c. "STUD".
.2 Blocking, furring, strapping, and bracing: spruce, pine or fir (SPF), 121c. and pine, 113d.

.2 Fastenings: to CAN/CSA-086.

.3 Douglas fir plywood: to CSA 0121, urea formaldehyde free. Thickness as indicated in Drawings.
.1 Panelling: G1S Good One Side Grade, sanded surfaces to Tables E-1 and E-2.

.4 Field applied wood preservative: copper napthenate to AWPA P8, green colour.

.5 Fire retardant treated plywood: Douglas Fir to CSA O121, G1S, fire retardant treated to CSA O80.27, maximum flame spread 25, maximum smoke developed 25.
.1 Backboard: 19 mm thick, sanded, to Table E-1.

.6 Construction adhesive: to CSA O112 Series, cartridge loaded.
.1 Maximum allowable VOC limit 140 g/L.
.2 SCAQMD Rule 1168, Adhesives and Sealants Applications.

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Apply wood preservative to wood in contact with concrete and masonry.

.2 Set items in place plumb, straight and level to a tolerance of 1:600 and rigidly secure in place.

.3 Construct continuous members from pieces of longest practical length.

.4 Install plywood backboards with countersunk screws.

3.1 INSTALLATION (Cont'd)

.5 Fit and install wood furring, strapping, grounds and blocking. Adequately size, correctly place and conceal members for finishes, fitments and for Work under other Sections. Do not assume that Drawings show required work exactly or completely. Anchor wood members securely in place.

.6 Install rough bucks, nailing strips and linings to rough openings as required for backing for frames and other Work.

.7 Use fire retardant lumber for blocking/framing in ceiling\spaces, partitions and bulkheads.

3.2 WORK ON EXISTING BUILDING

.1 Where new work connects with existing building, or alterations are required to existing building, carry out all necessary cutting and fitting to existing rough carpentry work.

.2 Where required, remove existing wood blocking, curbs and other rough carpentry items.

.3 Provide all new wood blocking, curbs and other rough carpentry items required.

END

PART 1 - GENERAL

1.1 REFERENCES

.1 American National Standards Institute (ANSI):
.1 ANSI A208.1-2009, Particleboard.
.2 ANSI A208.2-2009, Medium Density Fiberboard (MDF) for Interior Applications.
.3 ANSI Z124.3-2005, Plastic Lavatories.
.4 ANSI Z124.6-2007, Plastic Sinks.

.2 American National Standards Institute/National Particleboard Association/National Electrical Maufacturers Association (ANSI/NPA/NEMA):
.1 ANSI/BHMA A156.9-2010, Cabinet Hardware.
.2 ANSI/BHMA A156.11-2010, Cabinet Locks.
.3 ANSI/BHMA A156.16-2008, Auxiliary Hardware.

.3 ASTM International:
.1 ASTM C919-12, Standard Practical for Use of Sealants in Acoustical Applications.
.2 ASTM C920-11, Standard Specification for Elastomeric Joint Sealants.
.3 ASTM D570-98(2010)e1, Standard Test Method for Water Absorption of Plastics.
.4 ASTM D790-10, Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.
.5 ASTM D2583-13, Standard Test Method for Indentation Hardness of Rigid Plastics by Means of a Barcol Impressor.
.6 ASTM E84-12c, Standard Test Method for Surface Burning Characteristics of Building Materials.
.7 ASTM G21-09, Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi.

.4 Architectural Woodwork Manufacturers Association of Canada (AWMAC):
.1 AWI/AWMAC/WI AWS-2009.

.5 Canadian General Standards Board (CGSB):
.1 CGSB 1.108-M89, Bituminous Solvent Type Paint.
.2 CAN/CGSB-71.20-M88, Adhesive, Contact, Brushable.

.6 Canadian Standards Association (CSA):
.1 CSA B651-12, Accessible Design for the Built Environment.
.2 CSA O121-08(R2013), Douglas Fir Plywood.

1.1 REFERENCES (Cont'd)

.6 (Cont'd)
.3 CAN/CSA O132.2 Series-90(R2003), Wood Flush Doors.
.4 CSA Z204-94(R1999), Guideline for Managing Indoor Air Quality in Office Buildings.

.7 National Electrical Manufacturers Association (NEMA)
.1 NEMA LD 3-2005, High-Pressure Decorative Laminates.

.8 National Particleboard Association (NPA)

.9 South Coast Air Quality Management District (SCAQMD):
.1 SCAQMD Rule 1168-05, Adhesive and Sealant Applications, Amended January 7, 2005.

1.2 RELATED SECTIONS

.1 Section 05 50 01: Metal supports and aluminum reveals.

.2 Section 08 80 00: Glazing for millwork items.

1.3 IAQ - INDOOR AIR QUALITY

.1 Comply with CSA Z204, Guideline for Managing Indoor Air Quality in Office Buildings and CSA B651.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00 and AWS Section 1.

.2 Product Data:
.1 Submit manufacturer's instructions, printed product literature and data sheets for architectural woodwork and include product characteristics, performance criteria, physical size, finish and limitations.
.2 Submit two copies of WHMIS MSDS.

.3 Shop Drawings:
.1 Indicate details of construction, profiles, jointing, fastening and other related details.
.2 Indicate materials, thicknesses, finishes and hardware.
.3 Indicate locations of service outlets in casework, typical and special installation conditions, and connections, attachments, anchorage and location of exposed fastenings.

1.4 ACTION AND INFORMATIONAL SUBMITTALS (Cont'd)

.4 Samples:
.1 Submit for review and acceptance of each unit.
.2 Samples will be returned for inclusion into work.
.3 Submit duplicate samples of hardwood, softwood, plywood, particleboard, and MDF: sample size 300 x 300 mm.
.4 Submit duplicate samples of laminated plastic for colour selection.
.5 Submit duplicate samples of laminated plastic joints, edging, cutouts and postformed profiles.
.6 Two of each solid surface, in 100 x 75 x 10 mm samples.
.7 One of each item of finish carpentry hardware.

.5 Certifications: submit AWMAC GIS certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
.1 Architectural woodwork shall be manufactured and/or installed to the current AWMAC Architectural Woodwork Standards and shall be subject to an inspection at the plant and/or site by an appointed AWMAC Certified Inspector.
.2 Inspection costs shall be included in the bid price for this project. Contact your local AWMAC Chapter for details of inspection costs.
.3 Shop drawings shall be submitted to the AWMAC Chapter office for review before work commences.
.4 Work that does not meet the AWMAC Architectural Woodwork Standards, as specified, shall be replaced, reworked and/or refinished by the architectural woodwork contractor, to the approval of AWMAC, at no additional cost to the. Departmental Representative.
.5 If the woodwork contractor is an AWMAC Manufacturer member in good standing, a two (2) year AWMAC Guarantee Certificate will be issued.
.6 The AWMAC Guarantee shall cover replacing, reworking and/or refinishing any deficient architectural woodwork due to faulty workmanship or defective materials supplied by the woodwork contractor, which may appear during a two (2) year period following the date of issuance.
.7 If the woodwork contractor is not an AWMAC Manufacturer member they shall provide

1.4 ACTION AND INFORMATIONAL SUBMITTALS (Cont'd)

.5 Certifications:(Cont'd)
.7 (Cont'd)
the Departmental Representative with a two (2) year maintenance bond, in lieu of the AWMAC Guarantee Certificate, to the full value of the architectural woodwork contract.

1.5 ACCESSIBILITY

.1 Comply with CSA B651, Accessible Design for the Built Environment.

PART 2 - PRODUCTS

2.1 MATERIALS

.1 Exposed hardwood (WD-1): to AWI/AWMAC/WI Architectural Woodwork Standards, Section 3: kiln dried wood, moisture content 6-12%, premium grade, walnut species, uniform colour.

.2 Exposed softwood:
.1 S-DRY, graded and stamped to National Lumber Grades Authority, Standard Grading Rules for Canadian Lumber, December 2010, 202c. "C" CEDAR, INDUSTRIAL CLEAR.

.3 Concealed blocking and framing: S-DRY, graded and stamped to National Lumber Grades Authority, Standard Grading Rules for Canadian Lumber, December 2010, SPF, 121c. "STUD" and 101d. "D" FINISH.

.4 Concealed plywood: douglas fir to CSA 0121, Good One Side, urea formaldehyde free.

.5 High pressure decorative laminate (PL): Provide plastic laminates conforming to ANSI/NEMA LD 3 as follows:
.1 Flatwork face sheet: 1.2 mm thick, heavy wear resistance.
.2 Vertical interior face sheets: 0.8 mm thick.
.3 Postformed face sheet: 0.8 mm thick.
.4 Backing sheet: thickness to match face sheet, high pressure laminate, manufactured by same manufacturer as face sheet.
.5 Core: Plywood, particleboard and moisture resistant MDF as shown on Contract Drawings.
.6 Surface burning characteristics in accordance with ASTM E84.
.7 Colours and textures: As selected by the Departmental Representative.

2.1 MATERIALS (Cont'd)

.6 Medium Density Fibreboard (MDF): ANSI A208.2, no-added formaldehyde, moisture resistant MDF panels engineered for interior high moisture areas; meeting the following minimum criteria:
.1 Density: 769 kg/m3.
.2 Internal bond: 1.38 N/mm2.
.3 Modulus of rupture: 41.34 N/mm2.
.4 Modulus of elasticity: 4134 N/mm2.
.5 Moisture content: 4-6%.

.7 Particle board core: ANSI A208.1, Grade M2 of thickness indicated. Particleboard to be bound with waterproof adhesive and meeting the following minimum criteria:
.1 Density: minimum 705 kg/m3.
.2 Internal bond: 0.45 N/mm2.
.3 Modulus of rupture: 14.5 N/mm2.
.4 Modulus of elasticity: 2250 N/mm2.
.5 Face screw holding: 1000 N.
.6 Edge screw holding: 900 N.

.8 Panel adhesive: to AWI/AWMAC/WI AWS Section 4, Ecologo certified.

.9 Melamine low pressure decorative laminate (LPDL): to AWI/AWMAC/WI Architectural Woodwork Standards, Section 4.
.1 Particleboard core to ANSI A208.1, industrial grade, 720 kg/m^3, minimum 20% recycled content.
.2 Finish edges with 0.508 mm thick matching edge banding laminate.
.3 Melamine colours:
.1 Exterior exposed millwork surfaces: To be selected by the Departmental Representative.
.2 Interior of millwork surfaces: White colour.

.10 Solid surface top (SSU): to AWI/AWMAC/WI AWS Section 4; cast, non-porous homogeneous composite of acrylic modified polyester resins and fillers, reinforced with particle board backup plate, use same batch material for adjacent sheets. Heat and impact resistant, stain and chemical resistant, of following characteristics:
.1 Flexural strength: 68,950 kPa (10,000 psi) to ASTM D790.
.2 Ball impact resistance: no fracture, 0.227 kg ball (0.5 lb) @ 915 mm (36") on 6 mm (0.25") slab, 0.227 kg ball @ 3660 mm (144") on 13 mm (0.5") slab, to NEMA LD 3, Method 3.8.
.3 Hardness: 56 Barcol to ASTM D2583.

2.1 MATERIALS (Cont'd)

.10 Solid surface top (SSU):(Cont'd)
.4 Stain resistance: to ANSI Z124.3 and ANSI Z124.6, passes.
.5 High temperature resistance: to NEMA LD 3, Method 3.6, no change.
.6 Fungus and bacterial resistance: Does not support bacterial growth, to ASTM G21.
.7 Water absorption: Long term, 0.4% for 19 mm (0.75") material thickness, 0.6% for 13 mm (0.5"), 0.8% for 6 mm (0.25"), to ASTM D570.
.8 Light resistance: no effect, to NEMA LD 3, Method 3.3.
.9 Colour: Colour as selected by Departmental Representative from manufacturer's full colour range.

.11 Sealant: 1 component, silicone base, solvent curing to ASTM C919 and ASTM C920, primerless, Type S, Grade NS, Class 50, SWRI validated, Ecologo certified, mould and mildew resistant.

.12 Bituminous paint: acid and alkali resistant to CAN/CGSB-1.108, Type 2, Ecologo certified.

.13 Cord grommet: friction fit, PVC grommet and cap, 75 mm diameter.

.14 Construction adhesive: to CSA O112 Series, cartridge loaded.
.1 Maximum allowable VOC limit 140 g/L.
.2 SCAQMD Rule 1168, Adhesives and Sealants Applications.

.15 Glazing: In accordance with Section 08 80 00.

.16 Resilient base: In accordance with Section 09 65 00.

2.2 HARDWARE

.1 Cabinet hinge: to ANSI/BHMA-A156.9, type B81602.

.2 Magnetic catch: to ANSI/BHMA-A156.9, type B13171, heavy duty.

.3 Cabinet pull: to ANSI/BHMA-A156.9, type B32011, finish 628, satin aluminum, 76.2 mm centres, back mounted.

2.2 HARDWARE (Cont'd)

.4 Adjustable shelf standard: to ANSI/BHMA-A156.9, type B84061, surface application, open shelf rest type B84091.

.5 Vertical slotted shelf standard: to ANSI/BHMA- A156.9, type B04102, prefinished chrome with type B04112 shelf brackets, material and finish to match shelf standards.

.6 Drawer slide set: heavy duty to ANSI/BHMA-A156.9, type B05051, with zinc plate finish and AWI/AWMAC/WI AWS Section 10 and Appendix B Section 10-Casework, Drawer Slide Selection Guide, full extension, positive stop, self closing.
.1 AWS Heavy Duty:
.1 Static load capacity: 45.359 kg (100 lbs.) Commercial.
.2 Dynamic load capacity: 34.019 kg (75 lbs.) 50,000 cycles.

.7 Cam locks: to ANSI/BHMA-A156.11, key removable in locked and unlocked position, cam attached with screw or nut, type E07261, Grade 1.

.8 Coat hooks: to ANSI/BHMA-A156.16, type L13111.

.9 Sliding glass door lock: to ANSI/BHMA-A156.11, type E07191, ratchet type strike, lock case blocks outer door, key removable in locked position only.

.10 Draw bolts: type recommended by laminated plastic manufacturer.

.11 Edging: Black rubber edging as recommended by millwork fabricator and approved by the Departmental Representative.

.12 Adjustable feet: Adjustable feet as recommended by millwork fabricator and approved by the Departmental Representative to suit intended loading capacity and application.

.13 Sliding door hardware: Complete enclosed upper track mounting system to suit intended application and consisting of the following items:
.1 Track: Pre-drilled aluminum box track with 40 kg capacity.
.2 Lower guide channel: Press-fit in brown plastic, to be glued in.

2.2 HARDWARE (Cont'd)

.13 Sliding door hardware:(Cont'd)
.3 Rollers: Double roller running gear with nylon wheels.
.4 Accessories: Carrier base, track stopper, rubber buffer, bottom guide and steel adjusting pin.

2.3 FABRICATION

.1 To AWI/AWMAC Architectural Woodwork Manufacturers Association of Canada, Architectural Woodwork Quality Standards.

.2 Finish carpentry items required by this Section are to include but not be limited to the following:
.1 Casework, cabinets and countertops.
.2 Millwork table.
.3 Panels.
.4 Trims.

.3 Countertops: to AWI/AWMAC/WI Architectural Woodwork Standards, Section 11 and Appendix B Section 11, Premium Grade, fabricated from solid surfacing and plastic laminate as shown.

.4 Shop assemble units in size to allow passage to installed location.

.5 Match grain and colour of adjoining exposed natural finished wood.
.1 Before finishing exposed surfaces of woodwork: remove handling marks or effects of exposure to moisture by thorough final sanding over all surfaces of exposed portions, using appropriate grit sandpaper and clean before applying sealer or finish.

.6 Cover exposed faces and edges with laminated plastic where indicated.

.7 Shop apply laminated plastic with hairline joints, chamfer exposed edges.

.8 Apply bituminous paint to edge of cutouts in laminated plastic tops at sinks.

.9 Fabricate shelves and shelf gables as shown.

.10 Seal all surfaces for site finishing to WDI/AWMAC/WI AWS Section 5.

2.4 SHOP FINISHING

.1 Shop finish exposed hardwood with water based polyurethane to WDI/AWMAC/WI AWS Section 5, System 12.

PART 3 - EXECUTION

3.1 HARDWARE SCHEDULE

.1 Swinging doors:
- .1 1 pair cabinet hinges.
- .2 1 cabinet pull.
- .3 1 magnetic catch.
- .4 1 door lock.

.2 Drawers:
- .1 1 drawer slide set.
- .2 1 cabinet pull.
- .3 1 drawer lock.

.3 Adjustable shelves:
- .1 4 shelf standards.
- .2 4 rests per shelf.

3.2 INSTALLATION

.1 Set items in place, plumb, straight and level to a tolerance of 1:400 and rigidly secure in place in accordance with AWI/AWMAC/WI Architectural Woodwork Standards.

.2 Coordinate with applicable Sections as required for Work of this Section.

.3 Completely assemble units.

.4 Join abutting laminated plastic tops with draw bolts.

.5 Install casework and its components according to AWI/AWMAC/WI Architectural Woodwork Standards.

.6 Apply sealant to junction of backsplash and adjacent wall finish.

.7 Adjust hardware after cabinets installed for smooth effortless operation.

.8 Install cabinet doors and hardware to CAN/CSA-O132.2, Appendix A.

.9 Install door hardware in accordance with CAN/CSA-O132.2.4 Series 90. Adjust hardware

3.2 INSTALLATION (Cont'd)

.9 (Cont'd)
after doors installed for smooth effortless operation.

.10 Melamine panels: Assemble melamine millwork using dowelled/wafered-and-glue construction. Installed melamine panels shall not show any exposed fasteners on finished/exposed surfaces.

.11 Solid surfacing: Install solid surfacing materials in accordance with manufacturer's written instructions and as indicated on drawings.

END

PART 1 - GENERAL

1.1 REFERENCES

.1 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
.1 Material Safety Data Sheets (MSDS).

.2 Underwriter's Laboratories of Canada (ULC)
.1 CAN/ULC-S101-07, Standard Methods of Fire Endurance Tests of Building Construction and Materials.
.2 CAN/ULC-S102-10, Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.

1.2 SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00.

.2 Product Data:
.1 Submit manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.
.2 Submit two copies of WHMIS MSDS - Material Safety Data Sheets.

.3 Quality assurance submittals: submit following in accordance with Section 01 45 00.
.1 Test Reports:
.1 Submit product data including certified copies of test reports verifying fireproofing applied to substrate as constructed on project will meet or exceed requirements of Specification.
.2 Submit test results in accordance with CAN/ULC-S101 for fire endurance and CAN/ULC-S102 for surface burning characteristics.
.3 For assemblies not tested and rated, submit proposals based on related designs using accepted fireproofing design criteria.
.2 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

1.3 QUALITY ASSURANCE

.1 Qualifications:
.1 Installer: company specializing in sprayed-on fireproofing with 5 years documented experience and approved by manufacturer.

.2 Pre-installation meeting: Arrange with manufacturer's representative, Contractor, and Departmental Representative to inspect substrates, and to review installation procedures 48 hours in advance of installation.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Packing, shipping, handling and unloading:
.1 Deliver, store and handle materials in accordance with Section 01 61 00.
.2 Deliver, store and handle materials in accordance with manufacturer's written instructions.
.3 Deliver packaged materials in original unopened containers, marked to indicate brand name, manufacturer, and ULC markings.

.2 Storage and Protection:
.1 Store materials in dry location.
.2 Store and protect materials from exposure to harmful weather conditions and at temperature and humidity conditions recommended by manufacturer.
.3 Damaged or opened containers will be rejected.
.4 Packaging to indicate shelf-life and materials to be applied prior to expiration of shelf-life.
.5 Provide temporary enclosures to prevent spray from contaminating air beyond application area.
.6 Protect adjacent surfaces and equipment from damage by overspray, fall-out, and dusting of fireproofing materials.

.3 Waste Management and Disposal:
.1 Separate waste materials for reuse and recycling in accordance with Section 01 74 20.

1.5 AMBIENT CONDITIONS

.1 At temperatures less than 5°C, ensure that 5°C air and substrate temperature is maintained during and for 24 hours after application. Ensure that natural ventilation to properly dry the fireproofing during and subsequent to its application is provided. In

1.5 AMBIENT CONDITIONS (Cont'd)

.1 (Cont'd)
enclosed areas lacking openings for natural ventilation, ensure that interior air is circulated and exhausted to the outside.

.2 Maintain relative humidity within limits recommended fireproofing manufacturer.

.3 Ensure that natural ventilation to properly dry fireproofing during and subsequent to its application is provided.

.4 In enclosed areas lacking openings for natural ventilation, provide minimum of 4 air exchanges per hour by forced air circulation.

PART 2 - PRODUCTS

2.1 MATERIALS

.1 Sprayed fireproofing:
.1 ULC certified, sprayed fireproofing to match existing type. Provide new fireproofing where existing fireproofing has been damaged as a result of Work of this Project.
.2 Provide all components and accessories as required for installation of new fireproofing including but not limited to curing compounds and sealers. Types as recommended by manufacturer to suit intended application.

PART 3 - EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 PREPARATION

.1 Substrate: free of material, which would impair bond.

.2 Verify that painted substrates are compatible and have suitable bonding characteristics to receive fireproofing.

.3 Remove incompatible materials.

3.2 PREPARATION (Cont'd)

.4 Ensure that items required to penetrate fireproofing are placed before installation of fireproofing.

.5 Ensure that ducts, piping, equipment, or other items which would interfere with application of fireproofing are not positioned until fireproofing work is completed.

3.3 APPLICATION

.1 Apply bonding adhesive or primer to substrate if recommended by manufacturer.

.2 Apply fireproofing in separate coats in accordance with the manufacturer's written instructions to total thickness required to achieve fire ratings shown on the Contract Drawings. Comply with accepted ULC design.

.3 Apply fireproofing over substrate, building up to required thickness to cover substrate with monolithic blanket of uniform density and texture.

.4 Maintain continuity of fireproofing without gaps or voids.

.5 Tamp smooth, surfaces as indicated.

.6 Apply curing compound or sealer to surface of fireproofing as required by manufacturer.

3.4 FIELD QUALITY CONTROL

.1 Manufacturer's Field Services:
.1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Field Reports as described in PART 1 - SUBMITTALS.
.2 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.
.3 Schedule site visits, to review Work, as directed in PART 1 - QUALITY ASSURANCE.

.2 Inspection and Site Tests:
.1 Inspection and testing of fireproofing will be carried out by Testing Laboratory designated by Departmental Representative.
.2 Contractor to pay costs for testing, as specified in Section 01 29 83.

3.5 PATCHING

.1 Patch damage to fireproofing caused by testing or by other trades before fireproofing is concealed, or if exposed, before final inspection.

3.6 CLEANING

.1 Proceed in accordance with Section 01 74 11.

.2 Clean surfaces not indicated to receive fireproofing of sprayed material within 24 hours period after application.

.3 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END

PART 1 - GENERAL

1.1 REFERENCES

.1 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
.1 Material Safety Data Sheets (MSDS).

.2 Underwriter's Laboratories of Canada (ULC)
.1 CAN/ULC-S101-07, Standard Methods of for Fire Endurance Tests of Building Construction and Materials.
.2 CAN/ULC-S102-10, Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.
.3 CAN/ULC-S115-11, Standard Method of Fire Tests of Firestop Systems.

1.2 DEFINITIONS

.1 Fire Stop Material: device intended to close off opening or penetration during fire or materials that fill openings in wall or floor assembly where penetration is by cables, cable trays, conduits, ducts and pipes and poke-through termination devices, including electrical outlet boxes along with their means of support through wall or floor openings.

.2 Single Component Fire Stop System: fire stop material that has Listed Systems Design and is used individually without use of high temperature insulation or other materials to create fire stop system.

.3 Multiple Component Fire Stop System: exact group of fire stop materials that are identified within Listed Systems Design to create on site fire stop system.

.4 Continuity of Fire Separations: NBC 2010, Division B, Parts 3.1.8 and 3.1.9.1, 9.10.9):
.1 Wall, partition or floor assemblies required to be a fire separation shall be: constructed as a continuous element; have a fire resistance rating; have openings protected by a closure; and have penetrations sealed by a firestop.

1.3 SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00.

1.3 SUBMITTALS (Cont'd)

.2 Product Data:
.1 Submit manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.
.2 Submit two copies of WHMIS MSDS - Material Safety Data Sheets in accordance with Section 01 33 00.

.3 Shop Drawings:
.1 Submit shop drawings to show location, proposed material, reinforcement, anchorage, fastenings and method of installation.
.2 Construction details should accurately reflect actual job conditions.

.4 Samples:
.1 Submit duplicate 300 x 300 mm samples showing actual fire stop material proposed for project.

.5 Quality assurance submittals: submit following in accordance with Section 01 45 00:
.1 Test reports: in accordance with CAN/ULC-S101 for fire endurance and CAN/ULC-S102 for surface burning characteristics.
.1 Submit certified test reports from approved independent testing laboratories, indicating compliance of applied fire stopping with specifications for specified performance characteristics and physical properties.
.2 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

1.4 QUALITY ASSURANCE

.1 Qualifications:
.1 Installer: company specializing in fire stopping installations with 5 years documented experience and approved by manufacturer.
.2 All fire stopping material shall be from one manufacturer.
.3 All fire stopping installation work for entire project shall be by a single contractor experienced in firestopping. Individual disciplines shall NOT fire stop their own work.

.2 Pre-Installation Meetings: convene pre-installation meeting one week prior to

1.4 QUALITY ASSURANCE (Cont'd)

.2 Pre-Installation Meetings:(Cont'd) beginning work of this Section, with contractor's representative and Departmental Representative in accordance with Section 01 31 19 to:
.1 Verify project requirements.
.2 Review installation and substrate conditions.
.3 Co-ordination with other building subtrades.
.4 Review manufacturer's installation instructions and warranty requirements.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Packing, shipping, handling and unloading:
.1 Deliver, store and handle materials in accordance with Section 01 61 00.
.2 Deliver, store and handle materials in accordance with manufacturer's written instructions.
.3 Deliver materials to the site in undamaged condition and in original unopened containers, marked to indicate brand name, manufacturer, and ULC markings.

.2 Storage and Protection:
.1 Store materials in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
.2 Replace defective or damaged materials with new.

.3 Waste Management and Disposal:
.1 Separate waste materials for reuse and recycling in accordance with Section 01 74 20.

PART 2 - PRODUCTS

2.1 MATERIALS

.1 Fire stopping and smoke seal systems: in accordance with CAN/ULC-S115.
.1 Asbestos-free materials and systems capable of maintaining effective barrier against flame, smoke and gases in compliance with requirements of CAN/ULC-S115 and not to exceed opening sizes for which they are intended.
.2 Fire stop system rating: F.

.2 Service penetration assemblies: systems tested to CAN/ULC-S115.

2.1 MATERIALS (Cont'd)

.3 Service penetration fire stop components: certified by test laboratory to CAN/ULC-S115.

.4 Fire-resistance rating of installed fire stopping assembly in accordance with NBC.

.5 Fire stopping and smoke seals at openings around penetrations for pipes, ductwork and other mechanical items requiring sound and vibration control: elastomeric seal.

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

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

.8 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.

.9 Sealants for vertical joints: non-sagging.

PART 3 - EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 PREPARATION

.1 Examine sizes and conditions of voids to be filled to establish correct thicknesses and installation of materials.
.1 Ensure that substrates and surfaces are clean, dry and frost free.

.2 Prepare surfaces in contact with fire stopping materials and smoke seals to manufacturer's instructions.

.3 Maintain insulation around pipes and ducts penetrating fire separation.

.4 Mask where necessary to avoid spillage and over coating onto adjoining surfaces; remove stains on adjacent surfaces.

3.3 INSTALLATION

.1 Install fire stopping and smoke seal material and components in accordance with manufacturer's certified tested system listing.

.2 Seal holes or voids made by through penetrations, poke-through termination devices, and unpenetrated openings or joints to ensure continuity and integrity of fire separation are maintained.

.3 Provide temporary forming as required and remove forming only after materials have gained sufficient strength and after initial curing.

.4 Tool or trowel exposed surfaces to neat finish.

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

3.4 SEQUENCES OF OPERATION

.1 Proceed with installation only when submittals have been reviewed by Departmental Representative.

.2 Install floor fire stopping before interior partition erections.

.3 Mechanical pipe insulation: certified fire stop system component.
.1 Ensure pipe insulation installation precedes fire stopping.

3.5 CLEANING

.1 Proceed in accordance with Section 01 74 11.

.2 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

.3 Remove temporary dams after initial set of fire stopping and smoke seal materials.

3.6 SCHEDULE

.1 Fire stop and smoke seal at:
.1 Penetrations through fire-resistance rated masonry, concrete, and gypsum board partitions and walls.

3.6 SCHEDULE (Cont'd)

.1 (Cont'd)

.2 Top of fire-resistance rated masonry and gypsum board partitions.

.3 Intersection of fire-resistance rated masonry and gypsum board partitions.

.4 Control and sway joints in fire-resistance rated masonry and gypsum board partitions and walls.

.5 Penetrations through fire-resistance rated floor slabs and ceilings.

.6 Openings and sleeves installed for future use through fire separations.

.7 Around mechanical and electrical assemblies penetrating fire separations.

.8 Rigid ducts: greater than 129 cm^2: fire stopping to consist of bead of fire stopping material between retaining angle and fire separation and between retaining angle and duct, on each side of fire separation.

.9 Where required by National Building Code.

END

PART 1 - GENERAL

1.1 REFERENCES

.1 ASTM International:
.1 ASTM C920-11, Standard Specification for Elastomeric Joint Sealants.
.2 ASTM E90-09, Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.

.2 Environmental Choice Program (ECP):
.1 ECP/PCE-45-92, Sealants and Caulking.

1.2 ENVIRONMENTAL CHOICE PROGRAM

.1 Provide sealant products bearing the 'Ecologo' of the Environmental Choice Program, Department of the Environment, Canadian Environmental Protection Act, Environmental Choice Product Guidelines ECP/PCE-45-92 for Sealants and Caulking Compounds, except maximum VOC 60 g/L during application and curing.

.2 For primers and sealants, indicate VOC in g/L during application and curing.

1.3 PRODUCT DATA

.1 Submit manufacturer's literature indicating recommended surface preparation, sealant selection and primer for each substrate in accordance with Section 01 33 00.

1.4 DESIGN REQUIRMENTS

.1 Minimum sound transmission rating of installed partition, floor and ceiling to desired STC rating, tested to ASTM E90.

1.5 DELIVERY, STORAGE, AND HANDLING

.1 Deliver, handle, store and protect materials in accordance with Section 01 61 00.

.2 Deliver and store materials in original wrappings and containers with manufacturer's seals and labels, intact. Protect from freezing, moisture, water and contact with ground or floor.

PART 2 - PRODUCTS

2.1 SEALANTS

.1 Provide sealant products bearing Ecologo to ECP/PCE-45 with maximum VOC 60 g/L.

2.2 SEALANT MATERIAL DESIGNATIONS

.1 Silicones One Part '3'.
.1 To ASTM C920, primerless, Type S, Grade NS, Class 50, SWRI validated.

.2 Acoustical Sealant '6'.
.1 One part silicone to ASTM C920, primerless, Type S, Grade NS, Class 25, SWRI validated.

2.3 SEALANT SELECTION

.1 Perimeters of interior frames, as detailed and itemized: Designation 3.

.2 Perimeter of fixtures (e.g. sinks, basins, vanities): Designation 3.

.3 Exposed interior control joints in drywall: Designations 6.

2.4 JOINT CLEANER

.1 Non-corrosive and non-staining type, compatible with joint forming materials and sealant recommended by sealant manufacturer.

.2 Primer: to manufacturer's recommendations.

PART 3 - EXECUTION

3.1 PREPARATION OF JOINT SURFACES

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

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

.3 Do not apply sealants to joint surfaces treated with sealer, curing compound, water repellent, or other coatings unless tests have

3.1 PREPARATION OF JOINT SURFACES (Cont'd)

.3 (Cont'd)
been performed to ensure compatibility of materials. Remove coatings as required.

.4 Ensure joint surfaces are dry and frost free.

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

3.2 BACKUP MATERIAL

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

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

3.3 MIXING

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

3.4 APPLICATION

.1 Ventilate interior spaces during application and curing of sealants to maintain VOCs less than 50 g/l. Coordinate with building manager to ensure existing ventilation system or temporary ventilation supllies sufficient outside air.

.2 Sealant.
.1 Protect installed work of other trades from staining or contamination.
.2 Apply sealant in accordance with manufacturer's application manual and written instructions. Maintain STC rating of assemblies.
.3 Mask edges of joint where irregular surface or sensitive joint border exists to provide neat joint. remove tape after sealant applied.
.4 Apply sealant in continuous beads.
.5 Apply sealant using gun with proper size nozzle.
.6 Use sufficient pressure to fill voids and joints solid.
.7 Form surface of sealant with full bead, smooth, free from ridges, wrinkles, sags, air pockets, embedded impurities.
.8 Tool exposed surfaces before skinning begins to give slightly concave shape.

3.4 APPLICATION (Cont'd)

.3 Curing.
.1 Cure sealants in accordance with sealant manufacturer's instructions.
.2 Do not cover up sealants until proper curing has taken place.

.4 Cleanup.
.1 Clean adjacent surfaces immediately and leave work neat and clean.
.2 Remove excess and droppings, using recommended cleaners as work progresses.
.3 Remove masking tape after initial set of sealant.

END

PART 1 - GENERAL

1.1 RELATED SECTIONS

.1 Section 02 41 19: Salvaged doors and frames.

.2 Section 08 71 11: Hardware.

.3 Section 08 80 00: Glazing.

1.2 REFERENCES

.1 American National Standards Institute (ANSI):
.1 ANSI/BHMA A156.16-2008, Auxiliary Hardware.

.2 American Society for Testing and Materials International (ASTM)
.1 ASTM A568-11a/A568M-13, Standard Specification for Steel, Sheet, Carbon, Structural, and High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled, General Requirements for.
.2 ASTM A653/A653M-11, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

.3 Canadian General Standards Board (CGSB)
.1 CAN/CGSB-1.181-99, Ready-Mixed Organic Zinc-Rich Coating.

.4 Canadian Steel Door Manufacturers Association (CSDMA):
.1 Recommended Specifications for Commercial Steel Doors and Frames 2009.
.2 Recommended Dimensional Standards For Commercial Steel Doors and Frames 2009.
.3 Recommended Selection and Usage Guide for Commercial Steel Door and Frame Products, 2009.

.5 Underwriters Laboratories Canada (ULC)
.1 CAN/ULC-S702-09, Standard for Mineral Fibre Thermal Insulation for Buildings.

1.3 PRODUCT DATA SHEETS

.1 Submit product data sheets in accordance with Section 01 33 00.

1.4 QUALITY ASSURANCE

.1 Perform Work in accordance with requirements by a member of the Canadian Steel Door and Frame Manufacturers Association.

1.5 QUALIFICATIONS

.1 The manufacturer of steel doors and frames supplied under this section will be a member of the CSDMA - Canadian Steel Door Manufacturers Association.

PART 2 - PRODUCTS

2.1 MATERIALS

.1 Metal: tension levelled sheet steel to ASTM A568/A568M, Class 1, with ZF075 zinc coating on both sides designation to ASTM A653/A653M, minimum 30% total recycled content.

.2 Door core:
.1 Continuous interlocking steel ribs: 0.9 mm thick continuous interlocking steel stiffeners at 150 mm O.C., securely welded to each face sheet 150 mm O.C. maximum.
.1 Voids between stiffeners Fibreglass: loose batt type, density: 24 kg/m^3 minimum, to CAN/ULC-S702, Type 1, Ecologo certified.

.3 Filler: polyester based.

.4 Primer: zinc rich, organic, ready mix to CAN/CGSB-1.181, Ecologo certified.

.5 Door bumpers: to ANSI/BHMA-A156.16, type L03011.

.6 Salvaged doors and frames: In accordance with Section 02 41 19.

.7 Glazing: In accordance with Section 08 80 00.

2.2 FABRICATION

.1 To Canadian Steel Door Manufacturers Association (CSDMA), "Recommended Specifications for Commercial Steel Doors and Frames" and "Recommended Dimensional Standards for Commercial Steel Doors and Frames".

.2 Doors: material thickness, opening classification and duty rating to CSDMA "Recommended Selection and Usage Guide For

2.2 FABRICATION (Cont'd)

.2 Doors:(Cont'd)
Commercial Steel Door and Frame Products", hollow steel construction, filled with insulation, edges continuously welded or filled and sanded flush with no visible seams.

.3 Frames: 1.6 mm steel, welded type. Anchors adjustable, type to suit each jamb condition.

.4 Glass mouldings: formed steel.

.5 Install 3 door bumpers on strike jamb of single doors.

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Install frames and doors plumb, square and level in accordance with manufacturer's instructions and templates.

.2 Install doors clear of floor finishes, and with the correct rebate opening for the door installation. Install door silencers.

.3 Install glazing in accordance with Section 08 80 00.

.4 Provide even margins between doors and jambs and doors and flooring as follows:
.1 Hinge side: 1.0 mm.
.2 Latch side and head: 1.5 mm.
.3 Flooring: 13 mm.

.5 Secure anchorages and connections to adjacent construction.

.6 Existing doors and frames:
.1 Obtain existing hollow metal doors and frames, removed and stored under work of Section 02 41 19, and re-install them in their new locations where indicated.
.2 Where existing frames are to remain but the swing of new doors will change, provide new cut-outs in frames for new hardware. Provide metal fillers for existing cut-outs and continuously weld in place. Grind welds to flush finish.

.7 Touch-up with primer scratched or damaged zinc finish.

3.2 ADJUSTMENT AND CLEANING

.1 Adjust doors for smooth and balanced door movement.

.2 Clean doors and frames.

END

PART 1 - GENERAL

1.1 RELATED SECTIONS

.1 Section 08 71 11 - Finish Hardware.

.2 Section 08 80 00 - Glazing.

.3 Section 10 22 19 - Stud Type Demountable Partitions.

1.2 REFERENCES

.1 American National Standards Institute (ANSI):
.1 ANSI A208.1-2009, Particleboard.
.2 ANSI/BHMA A156.16-2008, Auxiliary Hardware.

.2 Architectural Woodwork Manufacturers Association of Canada (AWMAC):
.1 AWI/AWMAC/WI AWS-2009.

.3 Canadian Standards Association (CSA):
.1 CAN/CSA-O132.2 SERIES-90(R2003,) Wood Flush Doors.

.4 South Coast Air Quality Management District (SCAQMD) http://www.aqmd.gov/Default.htm:
.1 Rule 1168 Adhesive and Sealant Applications Amended Jan. 07, 2005.

1.3 SUBMITTALS

.1 Submit submittals in accordance with Section 01 33 00.

.2 Product data:
.1 Submit manufacturer's printed product literature, specifications and data sheets.
.2 Submit two copies of WHMIS MSDS - Material Safety Data Sheets. Indicate VOC':
.1 For caulking materials during application and curing.
.2 For door materials and adhesives.

.3 Shop drawings:
.1 Indicate door types and cutouts for lights, sizes, core construction, transom panel construction and cut-outs.

.4 Samples:
.1 Submit one 300 x 300 mm corner sample of wood door.
.2 Show door construction, core, glazing detail and faces.

1.3 SUBMITTALS (Cont'd)

.5 Manufacturer's Instructions: Submit manufacturer's installation instructions.

1.4 QUALITY ASSURANCE

.1 Perform Work in accordance with requirementsof AWI/AWMAC/WI, Architectural Woodwork Standards, Premium Grade, except as indicated otherwise.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Storage and Protection:
.1 Protect doors from dampness.
.2 Store doors in well ventilated room, off floor, in accordance with manufacturer's recommendations.
.3 Protect doors from scratches, handling marks and other damage. Crate doors.
.4 Store doors away from direct sunlight.

1.6 WARRANTY

.1 For wood doors specified in this Section 08 14 11, the 12 month warranty period prescribed in General Conditions is extended to three years.

PART 2 - PRODUCTS

2.1 MATERIALS AND FABRICATION

.1 Wood doors to CAN/CSA-0132.2 Series, flush:
.1 Interior Type II bond adhesive plywood faced, walnut, Grade 1 Premium, solid, mat-formed wood particleboard core, 35 mm hardwood stiles including 19 mm hardwood edge, 35 mm wood rails, solid wood lock reinforcing. Glass mouldings: walnut.

.2 Glazing: In accordance with Section 08 80 00.

.3 Aluminum door frames: In accordance with Section 10 22 19.

2.2 FABRICATION

.1 Fabricate doors to sizes as indicated on drawings.

.2 Fabricate doors square, true, and free from distortion waves, ridges or core ghost lines. Factory machine doors for finish hardware and flooring.

2.2 FABRICATION (Cont'd)

.3 Fabricate doors using hot press construction technology. Bond stiles and rails to core using adhesive. Sand for uniform thickness. Laminate door facing and trim, to assembled core in hot press.

.4 Vertical edge strips to match face veneer.

.5 Prepare doors for glazing. Provide hardwood glazing stops with mitred corners to match face veneer.

.6 Factory pre-machine doors for specified hardwood.

.7 All doors to be factory sealed at top, bottom and at hardware cut-outs.

PART 3 - EXECUTION

3.1 EXAMINATION

.1 Verify condition and dimensions of previously installed Work upon which this Section depends. Report defects to the Departmental Representative.

3.2 INSTALLATION

.1 Install doors and hardware in accordance with CAN/CSA-O132.2 Series 90, Appendix A and AWI Quality Standard, for wood door installation.

.2 Install doors plumb, rigid, square, clear of floor finishes, and with correct rebate opening for door installation.

.3 Provide even margins between doors and jambs and doors and flooring as follows:
.1 Hinge side: 1.0 mm.
.2 Latch side and head: 1.5 mm.
.3 Flooring: 13 mm.

.4 Install glazing in accordance with Section 08 80 00.

.5 Install stops.

.6 Replace the following wood doors:
.1 Warped more than 3 mm, measured at any point on door, relative to perfectly flat surface.

3.2 INSTALLATION (Cont'd)

.6 Replace the following wood doors:(Cont'd)

.2 Core telegraphing visible at 1500 mm distance, under final Site lighting conditions.

.7 Adjust hardware after doors installed for smooth effortless operation.

3.3 CLEANING

.1 Perform cleaning as soon as possible after installation to remove construction and accumlated environmental dirt.

.2 Remove traces of primer, caulking; clean doors and frames.

.3 Clean glass and glazing materials with approved non-abrasive cleaner.

.4 On completion of installation, remove surplus materials, rubbish, tools and equipment barriers.

END

PART 1 - GENERAL

1.1 RELATED SECTIONS

.1 Section 06 40 01: Hardware for cabinets.

.2 Section 08 11 13: Hollow metal door and frames.

.3 Section 08 14 11: Wood doors.

.4 Section 08 71 12: Low energy power door operator.

.5 Section 10 22 19: Aluminum door frames.

1.2 REFERENCES

.1 American National Standards Institute (ANSI):
.1 ANSI/BHMA A156.1-2006, Butts and Hinges.
.2 ANSI/BHMA A156.5-2010, Cylinders and Input Devices for Locks.
.3 ANSI/BHMA A156.28-2007, Keying Systems.

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

.3 Door Hardware Institute (DHI).

1.3 PRODUCT DATA SHEETS

.1 Submit one copy of product data sheets in accordance with Section 01 33 00.

.2 Product data sheets shall consist of catalogue cuts, manufacturer's name and number, finish and reference identification to specified standard.

1.4 SHOP DRAWINGS

.1 Submit shop drawings in accordance with Section 01 33 00 including the following:
.1 omplete hardware lists consisting of door locations, sizes, hardware manufacturer's catalogue numbers, finish symbols, quantities required and locations and mounting heights of each type of hardware.
.2 Supply templates and required information to door and frame manufacturer to enable accurate sizes, locations of cut-outs and reinforcement for hardware.

1.4 SHOP DRAWINGS (Cont'd)

.1 (Cont'd)
.3 Supply templates to required trade to arrange for provisions for accurate setting and fitting of hardware.

1.5 SCHEMATIC DIAGRAMS

.1 Submit schematic diagrams of electrical components for inclusion in maintenance manual specified in Section 01 33 00.

1.6 REFERENCES

.1 Standard hardware location dimensions in accordance with Canadian Metric Guide for Steel Doors and Frames (Modular Construction) prepared by CSDMA - Canadian Steel Door Manufacturers' Association and CSA B651-12, Accessible Design for the Built Environment.

.2 Use abbreviations and symbols recommended in "Abbreviations and Symbols as used in Architectural Door and Hardware Schedules and Specifications", 1983, published by the Door and Hardware Institute.

.3 Use hardware schedule format recommended in "Sequence and Format for the Hardware Schedule", June, 1984, published by the Door and Hardware Institute.

1.7 DEFINITIONS

.1 Master Key (MK):
.1 A key which operates all the master keyed locks or cylinders in a group, each lock or cylinder usually operated by its own change key.
.2 To combinate a group of locks or cylinders such that each is operated by its own key as well as by a master key for the entire group.

.2 Master Key System:
.1 Any keying arrangement which has two or more levels of keying.
.2 A keying arrangement which has exactly two levels of keying.

.3 Grand Master Key (GMK): The key which operates two or more separate groups of locks, each operated by a different master key.

.4 Grand Master Key System: A master key system which has exactly three levels of keying.

1.7 DEFINITIONS (Cont'd)

.5 Great Grand Master Key (GGMK): The key which operates two or more separate groups of locks, which are each operated by a different grand master key.

.6 Great Grand Master Key System: A master key system which has exactly four levels of keying.

.7 Top Master Key (TMK): The highest level master key in a master key system.

1.8 HARDWARE LIST

.1 Submit full hardware schedule in accordance with Section 01 33 00.

.2 Submit literature cuts, indicating hardware proposed, including make, model, base material, function, ANSI Function where ANSI used in this specification, Grade, Type, Series, BHMA finish, trim, ULC listing, UL listing, manufacturer and other pertinent information. Indicate which model or accessory is being provided where more than one model or accessory appears on a page.

PART 2 - PRODUCTS

2.1 GENERAL

.1 Provide hardware schedule to Departmental Representative for approval indicating products, materials and finishes. Do not order products until schedule has been approved by Departmental Representative.

.2 Finish hardware:
.1 Provide all finish hardware items as required for Work of this Project.
.2 New finish hardware items to match existing type. Coordinate with Section 08 71 12 as required to ensure compatibility between existing door hardware and new automatic door operators provided under Section 08 71 12.

.3 Carefully check and verify Hardware List against Contract Drawings to ensure that hardware listed can be used as specified. Inform Departmental Representative of concerns

2.1 GENERAL (Cont'd)

.3 (Cont'd)
regarding quality, quantity, operation or function of hardware selected:
.1 Verify hand of doors, examine details on Contract Drawings and at Site to ensure hardware supplied can be correctly installed and is correct for Work as constructed.
.2 Select hardware in accordance with applicable codes and regulations.
.3 Replace and pay for defective hardware including hardware which was incorrectly selected, and remedial and installation costs.

.4 Ensure that hardware selected will function correctly, meets Contract requirements and National Building Code and authorities having jurisdiction.

2.2 KEYING, ACCESSORIES AND FINISH

.1 Keying systems: to ANSI/BHMA-A156.28, to match existing system.

.2 Provide all accessories as required for complete and secure installation of finish hardware required by Work of this Project.

.3 Finish: To match existing finish.

.4 Finish fasteners to match the exposed surface on which they appear.

.5 Provide temporary construction keying.

.6 Hinge: to ANSI/BHMA-A156.1. to match existing.

.7 Locks: to ANSI/BHMA-A156.5, to match existing.

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Install hardware in accordance with manufacturer's installation instructions and applicable codes and regulations.

.2 Coordinate with applicable Sections as required for Work of this Section.

.3 Install hardware in accordance with hardware templates.

.4 Adjust fixed and operable hardware for correct clearances and function.

.5 Mount hardware in accordance with manufacturer's written instructions.

END

PART 1 - GENERAL

1.1 RELATED SECTIONS

.1 Section 08 11 13: Hollow metal doors.

.2 Section 08 14 11: Wood doors.

.3 Section 08 71 11: Door hardware.

.4 Division 26: Electrical work required for doors.

1.2 REFERENCES

.1 American National Standards Institute (ANSI):
.1 ANSI/BHMA-A156.10-2011, Power Operated Pedestrian Doors.
.2 SI/BHMA-A156.19-2007, Power Assistand Low Energy Power-Operated Doors.

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

.3 National Fire Protection Assocation:
.1 NFPA 80-2013, Standard for Fire Doors and Other Opening Protectives.

1.3 PRODUCT DATA SHEETS

.1 Submit one copy of product data sheets in accordance with Section 01 33 00 and 01 78 00 for each item specified below.

.2 Product data sheets shall consist of catalogue cuts, product number, manufacturer's name and phone number, finish and reference identification to specified standard.
.1 Where data sheets list multiple models or configurations on the same sheet, indicate which model is proposed.

.3 Submit data sheets indicating that operator conforms with all the requirements of ANSI/BHMA-A156.19. Highlight the following data:
.1 Opening and closing speeds are adjustable in accordance with requirements of Table 1.
.2 Doors require a force of not more than 67 N to open or stop door movement.
.3 Door operator acts as a normal door closer in the event of power loss. Manual resistance not to exceed limits stated.

1.3 PRODUCT DATA SHEETS (Cont'd)

.3 (Cont'd)
.4 The kinetic energy of the door controlled by this operator does not exceed 1.69 Nm (1.25 lb-ft).

1.4 WORK INCLUDED

.1 Provide labour, material, equipment, and tools to design and install swing door operators.

1.5 REQUIREMENTS OF REGULATORY AGENCIES

.1 Comply with design and signage requirements of CSA B651, Accessible Design for the Built Environment.

.2 Comply with the performance requirements of ANSI/BHMA-A156.19.

.3 Comply with the requirements of NFPA 80, 2-8.8.3, for interconnection of control and activation circuits with the building Fire Alarm system.

.4 Provide ULC or cUL labelled units and hardware in Fire Separations.

1.6 EXTENDED WARRANTY

.1 For the work in this Section 08 71 12 the standard warranty period of 12 months listed in the General Conditions is extended to 36 months.

PART 2 - PRODUCTS

2.1 MATERIALS

.1 In-header operator: ULC or cUL approved, completely contained in the door header requiring only electric, pneumatic or hydraulic power, sealed against dust and moisture. Complying with design requirements of ANSI/BHMA-A156.19, Power Assist and Low Energy Power Operated Doors.
.1 Ensure that automatic door operator is compatible with existing door hardware. Notify Departmental Representative immediately if any compatibility issues arise or become apparent.
.2 Operator housing: aluminum, maximum size 152 x 152 mm x door width, clear anodized, minimum wall thickness 4 mm.

2.1 MATERIALS (Cont'd)

.1 (Cont'd)

.3 Electric motor: 5 amp maximum, 120V, Built-in thermal overload protection and automatic re-set.

.4 Electronic control:

.1 Self-contained, solid state integrated circuit for controlling the operations and switching of the door operator.

.2 Provide low voltage power supply for all means of actuation.

.3 Provide adjustable time delay of 1 to 60 seconds.

.5 Single acting operation:

.1 Maintain constant opening pressure.

.2 Provide individual adjustment for opening and closing speeds and variable time delay. Provide separate adjustable creep speed/latch speed features on closing.

.3 Provide manual door closer function in the event of power failure.

.4 Force required for manual door operation is independent of opening speed setting.

.5 Provide closing function that overcomes air pressure differences and returns door to full close and latch.

.6 Time delay circuit:

.1 Provide time delay operation to allow electric strike to release prior to initiating opening cycle.

.7 Activating devices:

.1 Provide controls that cause door to open instantly when device located on approach side of door is actuated; hold door in open position, and cause door to close - unless re-actuation of opening impulse overrides such operation.

.2 Provide the following actuating devices:

.1 Press wall or jamb mount switches, 2 per door: wheelchair logo, colour blue, stainless steel.

.2 Power supply: ULC approved, rated for and compatible with electric latch retraction exit device.

.3 Key switch: rated for and compatible with Exit Device.

.4 Accessories: signage required by ANSI, stainless steel plate press buttons.

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Install swing door operator in accordance with manufacturer's recommendations using factory authorized and trained personnel.

.2 Coordinate with applicable Sections as required for Work of this Section.

.3 Install wall switches at 900 - 1000 mm above floor.

.4 Conceal wiring and fasteners.

.5 Field adjust opening and closing times in accordance with Table 1, ANSI/BHMA-A156.19.

END

PART 1 - GENERAL

1.1 RELATED SECTIONS

.1 Section 06 40 01: Laminated and tempered glass for millwork items as required.

.2 Section 08 11 13: Tempered and fire rated glass for door vision panels.

.3 Section 08 14 11: Tempered **g**lass for wood doors.

.4 Section 10 22 19: Tempered glass and glazing films for glazed screens.

1.2 REFERENCES

.1 American Society for Testing and Materials International (ASTM):
.1 ASTM C920-11, Standard Specification for Elastomeric Joint Sealants.
.2 ASTM D2240-05(2010), Standard Test Method for Rubber PropertyDurometer Hardness.

.2 Canadian General Standards Board (CGSB).
.1 CAN/CGSB-12.1-M90, Tempered or Laminated Safety Glass.

.3 Glass Association of North America (GANA).
.1 GANA Glazing Manual (50th Anniversary Edition).

.4 Underwriter`s Laboratories of Canada (ULC):
.1 ULC CAN4 S104-M2010, Standard Method for Fire Tests of Door Assemblies.
.2 ULC CAN4 S106-M80(R1985), Standard Method for Fire Tests of Window and Glass Block Assemblies.

1.3 SUBMITTALS

.1 Submit one representative sample of glazing film in accordance with Section 01 33 00.

.2 Approved sample may be installed as part of completed Work.

.3 Submit maintenance data for glazing film to Departmental Representative in accordance with Section 01 33 00.

1.4 QUALITY ASSURANCE

.1 Installers qualifications: Perform Work of this Section by a company that has a minimum of five years proven experience in the installation of glazing units of a similar size and nature.

.2 Fire Protective Rated Glass: Each lite shall bear permanent, non-removable label of ULC certifying it for use in tested and rated fire protective assemblies.

.3 Qualifications of glazing film applicator: trained, approved and certified by glazing film manufacturer. Submit proof of certification in writing to Departmental Representative in accordance with Sections 01 33 00 and 01 78 00.

.4 Glazing film inspection: manufacaturer's representative shall view the film at a distance of 3 m (10 feet) at angles up to 45 degrees from either side of the glass during regular daylight conditions (not in direct sunlight). To be accepted the film itself shall not appear distorted. Submit manufacturer's written inspection report to Departmental Representative in accordance with Sections 01 33 00 and 01 78 00.

PART 2 - PRODUCTS

2.1 MATERIALS

.1 Tempered safety glass (GL-1):
.1 to CAN/CGSB-12.1-M, Type 2-tempered, Class B, clear.
.2 Provide 6 mm thick glass for door vision panels and 12 mm thick glass for millwork cabinet and glass screens.

.2 Laminated safety glass (GL-2):
.1 to CAN/CGSB-12.1-M, Type 1-laminated, Class B, fabricated from panes of clear tempered glass, with clear laminated film thickness 0.06 mm. Total thickness as indicated.
.2 For use at glazing at millwork cabinet.

.3 Fire rated glass (FRG):
.1 Fire tested to ULC CAN4 S104-M and ULC CAN4 S106-M.
.2 Minimum 5 mm thick with appropriate labelling stating fire rating and approval, clear polished glass.

2.1 MATERIALS (Cont'd)

.3 Fire rated glass (FRG):(Cont'd)
.3 Fire rating: To meet required fire rating.
.4 For use at fire rated doors as indicated.

.4 Glazing film:
.1 Minimum 0.05 mm thick, pressure-sensitive, frosted glazing film, for use on intended glazed screen. Application pattern to be as shown on Contract Drawings.
.2 Adhesive type: Type as recommended by film manufacturer to suit intended application.

.5 Setting blocks: neoprene, Shore "A" 80 durometer hardness to ASTM D2240, 100 x 6 mm x width to suit glass.

.6 Glazing tape: preformed butyl with continuous spacer, Shore "A" 10-15 durometer hardness, paper release, black colour, 3 x 9.5 mm.

.7 Glazing tape (fire rated glass): Closed cell polyvinyl chloride (PVC) foam, coiled on release paper over adhesive on two sides, maximum water absorption by volume of 2 per cent. Glass panels that exceed 0.9 sq.m. for 90 minute ratings must be glazed with fire-rated glazing tape suppliedby the glazing manufacturer.

.8 Sealant: one part silicone to ASTM C920, Type S, Grade NS, Class 50.

2.2 FABRICATION

.1 Verify glazing dimensions on Site.

.2 Clearly label each glass lite with maker's name and glass type. Ensure labels are easily removable, non-residue depositing type. Do not remove labels until after Work is accepted by Departmental Representative.

.3 Fabricate glazing not less than 3 mm smaller than rebate size in either dimension; allow for edge spacers, shims, and setting blocks as necessary.

.4 Work shall have smooth finished surfaces free from distortion and defects detrimental to appearance and performance.

PART 3 - EXECUTION

3.1 EXAMINATION

.1 Verify that openings for glazing are correctly sized and within tolerance.

.2 Verify that surfaces of glazing channels or recesses are clean, free of obstructions, and ready to receive glazing.

.3 Laminated glass edges shall be completely covered by tape to protect against sealants and water if required by manufacturer.

3.2 PREPARATION

.1 Clean contact surfaces with solvent and wipe dry.

.2 Seal porous glazing channels or recesses with substrate compatible primer or sealer.

.3 Prime surfaces scheduled to receive sealant.

3.3 INSTALLATION

.1 Perform work in accordance with GANA Glazing Manual and Laminators Safety Glass Association - Standards Manual for glazing installation methods.

.2 Coordinate with applicable Sections as required for Work of this Section.

.3 Glass:
.1 Clean and dry surfaces.
.2 Apply glazing tape to fixed stops.
.3 Place setting blocks at 1/3 points.
.4 Set glass on setting blocks against tape.
.5 Apply glazing tape to glass.
.6 Install stops.
.7 Apply sealant behind stop and tool to smooth surface.

.4 Interior glass: Glaze interior glass using glazing gasket glazing tape.

.5 Millwork glass:
.1 Coordinate with Section 06 40 01 for the installation of the laminated and tempered glass at the intended millwork cabinet.

3.3 INSTALLATION (Cont'd)

.5 Millwork glass:(Cont'd)
.2 Install glazing straight, level and plumb.

.6 Fire rated glazing:
.1 Place setting blocks located at quarter points of glass with edge block no more than 150 mm from corners.
.2 Cut glazing tape to length and set against permanent stops, flush with sight lines to fit openings exactly, with stretch allowance during installation.
.3 Glaze vertically into labelled fire-rated metal frames or partition walls with same fire rating as glass and push against tape for full contact at perimeter of pane or unit.
.4 Place glazing tape on free perimeter of glazing in same manner described above.
.5 Install removable stop and secure without displacement of tape.
.6 Install so that appropriate ULC markings remain permanently visible.

.7 Glass Film
.1 Install glass film with adhesive, applied in accordance with film manufacturer's instructions.
.2 Place without air bubbles, creases or visible distortion.
.3 Fit tight to glass perimeter with razor cut edge.

3.4 CLEANING

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

.2 Clean glass using approved non-abrasive cleaner in accordance with manufacturer's instructions.

.3 Do not wash glass film for 30 days after installation.

.4 Do not use bristle brushes on glass film.

.5 Upon completion remove surplus materials, rubbish, tools and equipment.

3.5 PROTECTION OF FINISHED WORK

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

.2 After installation, mark each light with an "X" by using removable plastic tape or paste.
.1 Do not mark heat absorbing or reflective glass units.

.3 Repair damage to adjacent materials caused by glazing installation.

END

PART 1 - GENERAL

1.1 REFERENCES

.1 ASTM International
.1 ASTM C475/C475M-12, Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board.
.2 ASTM C645-11a, Standard Specification for Nonstructural Steel Framing Members.
.3 ASTM C840-11, Standard Specification for Application and Finishing of Gypsum Board.
.4 ASTM C954-11, Standard Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs From 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness.
.5 ASTM C1002-07, Standard Specification for Steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs.
.6 ASTM C1047-10a, Standard Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base.
.7 ASTM C1396/C1396M-13, Standard Specification for Gypsum Board.
.8 ASTM E90-09, Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.
.9 ASTM E2638-10, Standard Test Method for Objective Measurement of the Speech Privacy Provided by a Closed Room.

.2 Association of the Wall and Ceilings Industries International (AWCI)
.1 AWCI Levels of Gypsum Board Finish, latest edition.

.3 Canadian General Standards Board (CGSB)
.1 CAN/CGSB-51.34-M86(R1988), Vapour Barrier, Polyethylene Sheet for Use in Building Construction.
.2 CAN/CGSB-71.25-M88, Adhesive, for Bonding Drywall to Wood Framing and Metal Studs.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00.

.2 Product Data:
.1 Submit manufacturer's instructions, printed product literature and data sheets for gypsum board assemblies and include product

1.2 ACTION AND INFORMATIONAL SUBMITTALS (Cont'd)

.2 Product Data:(Cont'd)
.1 (Cont'd)
characteristics, performance criteria, physical size, finish and limitations.

.3 Samples:
.1 Submit for review and acceptance of each unit.
.2 Samples will be returned for inclusion into work.
.3 Submit duplicate 300 mm long samples of corner and casing beads.

1.3 DESIGN REQUIREMENTS

.1 Partition assembly to be fire resistance rated where indicated and required.

.2 Minimum sound transmission rating of installed panel partition to be desired STC rating, tested to ASTM E90.

.3 Minimum speech privacy category SPC to meet desired privacy rating, tested to ASTM E2638.

1.4 REGULATORY REQUIREMENTS

.1 Provide fire separations and fire protection exactly as specified in test design specification that validates the specified rating. Verify that work specified in other Sections, as a part of the entire assebmly, meets applicable validating test design specification.

1.5 DELIVERY, STORAGE AND HANDLING

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

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

.3 Storage and Handling Requirements:
.1 Store gypsum board assemblies materials level in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
.2 Store and protect gypsum board assemblies from nicks, scratches, and blemishes.

1.5 DELIVERY, STORAGE AND HANDLING (Cont'd)

.3 Storage and Handling Requirements:(Cont'd)
.3 Protect from weather, elements and damage from construction operations.
.4 Handle gypsum boards to prevent damage to edges, ends or surfaces.
.5 Replace defective or damaged materials with new.

1.6 AMBIENT CONDITIONS

.1 Maintain temperature 10 degrees C minimum, 21 degrees C maximum for 48 hours prior to and during application of gypsum boards and joint treatment, and for 48 hours minimumafter completion of joint treatment.

.2 Apply board and joint treatment to dry, frost free surfaces.

.3 Ventilation: ventilate building spaces as required to remove excess moisture that would prevent drying of joint treatment material immediately after its application.

PART 2 - PRODUCTS

2.1 MATERIALS

.1 Standard board (regular and Type X): to ASTM C1396/C1396M, 15.9 mm thick board, unless otherwise indicated. Furnish Type X board where indicated and required, 1200 mm wide x maximum practical length, ends square cut, edges squared.

.2 Metal furring runners, hangers, tie wires, inserts, anchors: to ASTM C645.

.3 Drywall furring channels: 0.5 mm core thickness galvanized steel channels for screw attachment of gypsum board.

.4 Resilient clips: 0.5 mm base steel thickness galvanized steel for resilient attachment of gypsum board.

.5 Steel drill screws: to ASTM C1002.

.6 Stud adhesive: to CAN/CGSB-71.25.

.7 Laminating compound: as recommended by manufacturer, asbestos-free.

2.1 MATERIALS (Cont'd)

.8 Casing beads, corner beads, control joints and edge trim: to ASTM C1047, zinc-coated by hot-dip process, 0.5 mm base thickness, perforated flanges, one piece length per location.

.9 Sealants: in accordance with Section 07 90 00.

.10 Primer: Where indicated by board manufacturer, provide primer as required to achieve finishes as defined in ASTM C840.

.11 Joint reinforcing tape:
.1 Standard gypsum board: ASTM C475/C475M; 50 mm wide x 0.25 mm thick, perforated paper, with chamfered edges.

.12 Polyethylene: to CAN/CGSB-51.34, Type 2.

.13 Joint compound: to ASTM C475/C475M, asbestos-free.

.14 Access door:
.1 Non-rated, medium duty steel security access door, sized at 610 x 610 mm, flush mounted access door constructed of 2.7 mm thick (12 ga.) door and 2.7 mm thick (12 ga.) steel frame.
.2 Door flush to frame with rounded safety corners and reinforced panel complete with one piece outer flange welded to mounting frame.
.3 Door to have continuous concealed hinge and master keyed in accordance with Section 08 71 11.
.4 Finish: 5 stage iron phosphate preparation with prime coat of white alkyd baking enamel.

PART 3 - EXECUTION

3.1 EXAMINATION

.1 Verification of Conditions: verify conditions of substrates previously installed under other Sections or Contracts are acceptable for gypsum board assemblies installation in accordance with manufacturer's written instructions.
.1 Visually inspect substrate in presence of Departmental Representative.
.2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.

3.1 EXAMINATION (Cont'd)

.1 (Cont'd)

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

3.2 ERECTION

.1 Do application and finishing of gypsum board to ASTM C840 except where specified otherwise.

.2 Erect hangers and runner channels for suspended gypsum board ceilings to ASTM C840 except where specified otherwise.

.3 Support light fixtures by providing additional ceiling suspension hangers within 150 mm of each corner and at maximum 600 mm around perimeter of fixture.

.4 Install work level to tolerance of 1:1200.

.5 Frame with furring channels, perimeter of openings for access panels, light fixtures, diffusers, and grilles.

.6 Install 19 x 64 mm furring channels parallel to, and at exact locations of steel stud partition header track.

.7 Furr for gypsum board faced vertical bulkheads within and at termination of ceilings.

.8 Furr above suspended ceilings for gypsum board fire and sound stops and to form plenum areas as indicated.

.9 Install wall furring for gypsum board wall finishes to ASTM C840, except where specified otherwise.

.10 Furr openings and around built-in equipment, cabinets, access panels, on four sides. Extend furring into reveals. Check clearances with equipment suppliers.

.11 Furr duct shafts, beams, columns, pipes and exposed services where indicated.

.12 Erect drywall resilient furring transversely across studs, spaced maximum 600 mm on centre and not more than 150 mm from ceiling/wall juncture. Secure to each support with 25 mm drywall screw.

3.2 ERECTION (Cont'd)

.13 Install 150 mm continuous strip of 12.7 mm gypsum board along base of partitions where resilient furring installed.

3.3 APPLICATION

.1 Apply gypsum board after bucks, anchors, blocking, sound attenuation, electrical and mechanical work have been approved.

.2 Coordinate with applicable Sections as required for Work of this Section.

.3 Apply single or double layer gypsum board to metal furring or framing using screw fasteners for first layer, and laminating adhesive for second layer. Maximum spacing of screws 300 mm on centre.

.1 Single-Layer Application:

.1 Apply gypsum board on ceilings prior to application of walls to ASTM C840.

.2 Apply gypsum board vertically or horizontally, providing sheet lengths that will minimize end joints.

.2 Double-Layer Application:

.1 Install gypsum board for base layer and exposed gypsum board for face layer.

.2 Apply base layer to ceilings prior to base layer application on walls; apply face layers in same sequence. Offset joints between layers at least 250 mm.

.3 Apply base layers at right angles to supports unless otherwise indicated.

.4 Apply base layer on walls and face layers vertically with joints of base layer over supports and face layer joints offset at least 250 mm with base layer joints.

.4 Apply single layer gypsum board to concrete or concrete block surfaces, where indicated, using laminating adhesive.

.1 Comply with gypsum board manufacturer's recommendations.

.2 Brace or fasten gypsum board until fastening adhesive has set.

.3 Mechanically fasten gypsum board at top and bottom of each sheet.

.5 Apply 12 mm diameter bead of acoustic sealant continuously around periphery of each face of partitioning to seal gypsum board/structure junction where partitions abut fixed building components. Seal full perimeter of cut-outs

3.3 APPLICATION (Cont'd)

.5 (Cont'd)
around electrical boxes, and ducts, in partitions where perimeter sealed with acoustic sealant.

.6 Install ceiling boards in direction that will minimize number of end-butt joints. Stagger end joints at least 250 mm.

.7 Install gypsum board on walls vertically to avoid end-butt joints. At stairwells and similar high walls, install boards horizontally with end joints staggered over studs, except where local codes or fire-rated assemblies require vertical application.

.8 Install gypsum board with face side out.

.9 Do not install damaged or damp boards.

.10 Locate edge or end joints over supports. Stagger vertical joints over different studs on opposite sides of wall.

3.4 FIRE RATED ASSEMBLIES

.1 Install products in fire rated assemblies ins trict accordance with applicable ULC tested and approved designs.

3.5 INSTALLATION

.1 Erect accessories straight, plumb or level, rigid and at proper plane. Use full length pieces where practical. Make joints tight, accurately aligned and rigidly secured. Mitre and fit corners accurately, free from rough edges. Secure at 150 mm on centre.

.2 Install casing beads around perimeter of suspended ceilings.

.3 Install casing beads where gypsum board butts against surfaces having no trim concealing junction and where indicated. Seal joints with sealant.

.4 Provide continuous polyethylene dust barrier behind and across control joints.

.5 Locate control joints at changes in substrate construction.

.6 Install control joints straight and true.

3.5 INSTALLATION (Cont'd)

.7 Construct expansion joints as required, at building expansion and construction joints. Provide continuous dust barrier.

.8 Install expansion joint straight and true.

.9 Splice corners and intersections together and secure to each member with 3 screws.

.10 Access doors:
.1 Install access doors in accordance with manufacturer's written instructions.
.2 Rigidly secure frames to furring or framing systems.

.11 Finish face panel joints and internal angles with joint system consisting of joint compound, joint tape and taping compound installed according to manufacturer's directions and feathered out onto panel faces.

.12 Gypsum Board Finish: finish gypsum board walls and ceilings to following levels in accordance with AWCI Levels of Gypsum Board Finish:
.1 Levels of finish:
.1 Level 4 (typical): Unless otherwise indicated, provide the noted finish level as the typical gypsum board finish. Embed tape for joints and interior angles in joint compound and apply three separate coats of joint compound over joints, angles, fastener heads and accessories; surfaces smooth and free of tool marks and ridges.

.13 Finish corner beads, control joints and trim as required with two coats of joint compound and one coat of taping compound, feathered out onto panel faces.

.14 Fill screw head depressions with joint and taping compounds to bring flush with adjacent surface of gypsum board so as to be invisible after surface finish is completed.

.15 Sand lightly to remove burred edges and other imperfections. Avoid sanding adjacent surface of board.

.16 Completed installation to be smooth, level or plumb, free from waves and other defects and ready for surface finish.

3.5 INSTALLATION (Cont'd)

.17 Apply one coat of white primer sealer over surface to be textured. When dry apply textured finish in accordance with manufacturer's instructions.

.18 Mix joint compound slightly thinner than for joint taping.

.19 Apply thin coat to entire surface using trowel or drywall broad knife to fill surface texture differences, variations or tool marks.

.20 Allow skim coat to dry completely.

.21 Remove ridges by light sanding or wiping with damp cloth.

3.6 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11.
.1 Leave Work area clean at end of each day.
.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11.

.2 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 20.
.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.7 PROTECTION

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

.2 Repair damage to adjacent materials caused by gypsum board assemblies installation.

END

PART 1 - GENERAL

1.1 REFERENCES

.1 American Society for Testing and Materials International, (ASTM).
.1 ASTM C645-11a, Standard Specification for Nonstructural Steel Framing Members.
.2 ASTM C754-11, Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products.
.3 ASTM E90-09, Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.

1.2 DESIGN REQUIREMENTS

.1 Partition assembly to be fire resistance rated where indicated and required.

.2 Minimum sound transmission rating of installed panel partition to be desired STC rating, tested to ASTM E90.

.3 Design ceiling suspension system in accordance with manufacturer's printed directions and ASTM C754.

.4 Design ceiling system for adequate support of electrical fixtures as required by the current bulletin of the Electrical Safety Authority.

.5 Design hanger anchor and entire suspension system static loading not to exceed 25% of their ultimate capacity.

.6 Design suspension system to support weight of mechanical and electrical items such as air handling boots and lighting fixtures, and with adequate support to allow rotation/relocation of light fixtures. Coordinate with applicable Sections as required for this Work.

.7 Design of wall assemblies with a height greater than 3000 mm.

.8 Design subframing as necessary to accommodate, and to circumvent, conflicts and interferences where ducts or other equipment prevent the regular spacing of hangers.

1.3 QUALITY ASSURANCE

.1 Retain a Professional Engineer, licensed in Province of Ontario, with experience in Work of comparable complexity and scope, to perform following services as part of Work of this Section:
.1 Design of suspended gypsum board assemblies.
.2 Design of steel studs greater than 3000 mm in height.
.3 Review, stamp, and sign shop drawings and design calculations.
.4 Conduct shop and on-site inspections, prepare and submit written inspection reports verifying that this part of Work is in accordance with Contract Documents and reviewed shop drawings.

.2 Qualifications: Execute the Work of this Section by skilled, qualified, and experienced workers trained in the installation of the Work of this Section.

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

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

.5 Pre-Installation Meetings: conduct pre-installation meeting to verify project requirements, manufacturer's installation instructions and manufacturer's warranty requirements. Comply with Section 01 31 19.

1.4 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Section 01 74 20.

.2 Remove from site and dispose of packaging materials at appropriate recycling facilities.

.3 Collect and separate for disposal paper, plastic, polystyrene, corrugated cardboard, packaging material for recycling in accordance with Waste Management Plan.

.4 Divert unused metal materials from landfill to metal recycling facility approved by Departmental Representative.

1.4 WASTE MANAGEMENT AND DISPOSAL (Cont'd)

.5 Divert unused gypsum materials from landfill to recycling facility approved by Departmental Representative.

PART 2 - PRODUCTS

2.1 MATERIALS

.1 Non-load bearing channel stud framing: to ASTM C645, stud size as indicated on Drawings, roll formed from hot dipped galvanized steel sheet, for screw attachment of gypsum board. Knock-out service holes to suit stud spacing. Steel: minimum 25% recycled content.
.1 0.53 mm (25 ga.)for typical applications and studs less than 3000 mm high.
.2 0.91 mm (20 ga.) for steel studs greater than 3000 mm high.

.2 Floor and ceiling tracks: to ASTM C645, in widths to suit stud sizes, 32 mm flange height. Steel: minimum 25% recycled content.

.3 Metal channel stiffener: 1.4 mm thick cold rolled steel, coated with rust inhibitive coating, minimum 25% recycled content.

.4 Acoustic insulation: mineral fibre batt, 40 kg/m^3, Ecologo certified.

.5 Acoustical sealant: in accordance with Section 07 90 00.

PART 3 - EXECUTION

3.1 EXAMINATION

.1 Verification of Conditions: verify conditions of substrates previously installed under other Sections or Contracts are acceptable for gypsum board assemblies installation in accordance with manufacturer's written instructions.
.1 Visually inspect substrate in presence of Departmental Representative.
.2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 ERECTION

.1 Install steel framing members to receive screw-attached gypsum board in accordance with ASTM C754 except where specified otherwise.

.2 Align partition tracks at floor and ceiling and secure at 600 mm on centre maximum.

.3 Place studs vertically at 400 mm on centre, unless otherwise indicated, and not more than 50 mm from abutting walls, and at each side of openings and corners. Position studs in tracks at floor and ceiling. Cross brace steel studs as required to provide rigid installation to manufacturer's instructions.

.4 Erect metal studding to tolerance of 1:1000.

.5 Attach studs to bottom and ceiling track using screws.

.6 Co-ordinate simultaneous erection of studs with installation of service lines. When erecting studs ensure web openings are aligned.

.7 Co-ordinate erection of studs with installation of door/window frames and special supports or anchorage for work specified in other Sections.

.8 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.

.9 Install heavy gauge single jamb studs at openings.

.10 Erect track at head of door/window openings and sills of sidelight/window openings to accommodate intermediate studs. Secure track to studs at each end, in accordance with manufacturer's instructions. Install intermediate studs above and below openings in same manner and spacing as wall studs.

.11 Frame openings and around built-in equipment, cabinets, access panels, on four sides. Extend framing into reveals. Check clearances with equipment suppliers.

3.2 ERECTION (Cont'd)

.12 Provide 40 mm stud or furring channel secured between studs for attachment of fixtures, attached to steel stud partitions.

.13 Install steel studs or furring channel between studs for attaching electrical and other boxes.

.14 Extend partitions to ceiling height except where noted otherwise on drawings.

.15 Maintain clearance under beams and structural slabs to avoid transmission of structural loads to studs.

.16 Install continuous insulating strips to isolate studs from uninsulated surfaces.

.17 Install two continuous beads of acoustical sealant or insulating strip under studs and tracks around perimeter of sound control partitions.

.18 Between framing acoustic insulation:
.1 Apply batt insulation between framing members tight to friction fit.
.2 Fit batt insulation tight to projections through insulation and adjoining insulation.

3.3 CLEANING

.1 Upon completion of installation, remove surplus materials, rubbish, tools and equipment barriers.

END

PART 1 - GENERAL

1.1 REFERENCES

.1 American Society for Testing and Materials (ASTM)

.1 ASTM C635-13, Specification for the Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings.

.2 ASTM C636-13, Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels.

.3 ASTM E1264-08e1, Classification for Acoustical Ceiling Products.

1.2 DESIGN REQUIREMENTS

.1 Design ceiling suspension systems in accordance with ASTM C636 and manufacturer's printed directions.

.2 Design tile ceiling system for adequate support of electrical fixtures as required by the current bulletin of the Electrical Safety Authority. Acoustic panel system is not designed to carry the weight of electrical equipment.

.3 Design hanger anchor and entire suspension system static loading not to exceed 25% of their ultimate capacity including lighting fixture dead loads.

.4 Design tile suspension system to support weight of mechanical and electrical items such as air handling boots and lighting fixtures, and with adequate support to allow rotation/relocation of light fixtures. Acoustic panel system is not designed to carry the weight of mechanical and electrical equipment.

.5 Design subframing as necessary to accommodate, to avoid conflicts and interferences where ducts or equipment prevent regular spacing of hangers.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit submittals in accordance with Section 01 33 00.

.2 Product Data:
.1 Submit manufacturer's instructions, printed product literature and data sheets for acoustical suspension and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Shop drawings:
.1 Submit drawings stamped and signed by professional engineer registered or licensed in Province of Ontario, Canada.
.2 Submit reflected ceiling plans for special grid patterns as indicated.
.3 Indicate lay-out, insert and hanger spacing and fastening details, access door dimensions, and locations and acoustical unit support at ceiling fixture.

.4 Samples:
.1 Submit for review and acceptance of each unit.
.2 Samples will be returned for inclusion into work.
.3 Submit one representative model of ceiling suspension system.
.4 Ceiling system to show basic construction and assembly, treatment at walls, recessed fixtures, splicing, interlocking, finishes, acoustical unit installation.

.5 Certificates: Submit certificate stating that suspended ceiling systems provide adequate support for electrical fixtures, as required by current bulletin of Electrical Inspection Department of Burlington Hydro.

.6 Closeout submittals:
.1 Operation and Maintenance Data: submit operation and maintenance data for acoustical suspension for incorporation into manual.

1.4 MOCK-UP

.1 Mock-up:
.1 Construct mock-ups in accordance with Section 01 45 00.
.2 Construct mock-up 3 m^2 minimum of each type of acoustical tile ceiling including one inside corner and one outside corner.
.3 Construct mock-up where directed.

1.4 MOCK-UP (Cont'd)

.1 Mock-up:(Cont'd)
.4 Allow 24 hours for inspection of mock-up by Departmental Representative before proceeding with ceiling work.
.5 When accepted, mock-up will demonstrate minimum standard for this work. Mock-up may remain as part of the finished work.

1.5 DELIVERY, STORAGE AND HANDLING

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

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

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

.4 Packaging Waste Management: remove for reuse and return of pallets, crates, padding and packaging materials.

1.6 EXTRA MATERIALS

.1 Provide extra materials of acoustic units in accordance with Section 01 78 00.

.2 Provide acoustical units amounting to 2% of gross ceiling area for each pattern and type required for project.

.3 Extra materials to be from same production run as installed materials.

.4 Clearly identify each type of acoustic unit, including colour and texture.

.5 Deliver to Departmental Representative, upon completion of the work of this section.

.6 Store where directed by Departmental Representative.

PART 2 - PRODUCTS

2.1 MATERIALS

.1 Heavy duty system to ASTM C635/C635M, to match existing system.

.2 Acoustic units (ACU):
.1 Conforming to ASTM E1264, to match existing acoustic ceiling tile.
.2 Provide samples for the approval of the Departmental Representative.

.3 Suspension system: non-fire rated, exposed tee bar grid, including wall moulding.

.4 Exposed tee bar grid components for ACU: cold rolled steel, zinc coated, shop painted, satin sheen, white, interlocking, main and cross tee of double web with rectangular bulb, depth governed by span, exposed face: To match existing type.

.5 Hangers: 3.6 mm galvanized soft annealed steel wire. Coordinate with Section 02 41 19 as required for salvaged ceiling hangers to be re-used at new ceiling assembly.

.6 Accessories: splices, clips, wire ties, retainers and wall moulding, to complement suspension system components. To match existing types and as recommended by ceiling manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

.1 Verification of Conditions: verify conditions of substrates previously installed under other Sections or Contracts are acceptable for acoustical ceiling tile and track installation in accordance with manufacturer's written instructions.
.1 Visually inspect substrate in presence of Departmental Representative.
.2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 INSTALLATION

.1 Install in accordance with ASTM C636/C636M, reviewed shop drawings and manufacturer's written instructions.

.2 Install suspension system to manufacturer's instructions and Certification Organizations tested design requirements.

.3 Make modifications to existing components as required to suit new layout. Leave re-installed work neat and clean.

.4 Co-ordinate suspension system with related components.

.5 Do not erect ceiling suspension system until work above ceiling has been inspected and approved by Departmental Representative.

.6 Support suspension system main runners at 1200 mm oc maximum with hangers from structure. Assembly shall support super-imposed loads. Maximum permissible deflection, 1/360th of span to ASTM C635/C635M deflection test.

.7 Attach cross member to main runner to provide rigid assembly.

.8 Acoustic lay-in tiles:
.1 Install acoustic tile in grid system openings supported by bottom flanges of members. Provide special shapes and sizes to provide a complete installation by cutting tile to fit into openings. Fit tile moderately tight between upright legs of members.
.2 Carefully cut and trim acoustic tiles to accommodate items piercing the finished ceiling plane.
.3 Cut acoustic units to fit adjacent work. Butt joints tight, terminate edges with moulding.

.9 Install moulding at junction of acoustic unit ceiling and other materials around entire length of joint.

3.3 INTERFACE WITH OTHER WORK

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

3.4 CLEANING

.1 Cleaning:
.1 Leave Work area clean at end of each day.
.2 Upon completion remove surplus materials, rubbish, tools and equipment.
.3 Touch up scratches, abrasions, voids and other defects in painted surfaces.

.2 Waste Management: separate waste materials for reuse and recycling.
.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.5 PROTECTION

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

.2 Repair damage to adjacent materials caused by acoustical suspension installation.

END

PART 1 - GENERAL

1.1 REFERENCES

.1 American Society for Testing and Materials (ASTM):
.1 ASTM D2047-11, Standard Test Method for Static Coefficient of Friction of Polish-Coated Floor Surfaces as Measured by the James Machine.
.2 ASTM F710-11, Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring.
.3 ASTM F970-07(2011), Standard Test Method for Static Load Limit.
.4 ASTM F1516-13, Standard Practice for Sealing Seams of Resilient Floor Products by the Heat Weld Method.
.5 ASTM F1861-08(2012)e1, Standard Specification for Resilient Wall Base.

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

.3 European Standards (EN):
.1 EN 427-1994, Determination of the side length, squareness and straightness of tiles.
.2 EN 428-1993, Resilient floor coverings; determination of overall thickness.

.4 Underwriter's Laboratories of Canada (ULC)
.1 CAN/ULC-S102.2-M-10, Method of Test for Surface Burning Characteristics of Flooring, Floor Coverings, and Miscellaneous Materials and Assemblies.

.5 Environmental Choice Program (ECP):
.1 ECP/PCE-44-92, Adhesives.

.6 International Organization for Standardization (ISO):
.1 ISO 717-2-13, Acoustics - Rating of Sound Insulation in Buildings and of Building Elements - Part 2: Impact Sound Insulation.

.7 Scientific Certification Systems (SCS)
.1 SCS-EC10.2-2007, Indoor Air Quality Performance.

1.2 WHMIS

.1 Submit WHMIS MSDS - Material Safety Data Sheets acceptable to Labour Canada and Health Canada for primer, cement and adhesive. Indicate VOC content.

.2 Submit WHMIS MSDS in accordance with Sections 01 33 00 and 01 78 00.

1.3 MAINTENANCE DATA

.1 Provide maintenance data for resilient flooring for incorporation into operation and maintenance manual specified in Section 01 78 00.

1.4 SUBMITTALS

.1 Submit a list of 6 projects (with contact people and phone numbers) completed within the previous 12 months which use the same systems specified here in accordance with Section 01 33 00.

.2 Submit copy of flooring manufacturer's installation procedures in accordance with Sections 01 33 00 and 01 78 00.

.3 Submit copy of installer's certificate of competence granted by the linoleum manufacturer in accordance with Sections 01 33 00 and 01 78 00.

.4 Submit letter stating that the moisture content of concrete slab and the ph of the surface is within manufacturer's written guidelines for proposed flooring system.

.5 Do not proceed with flooring installation if the concrete slab moisture content is over 3.0 lbs/1000 S.F for vinyl. Contact the manufacturer's representative and inform the Departmental Representative immediately.

.6 Submit a cut diagram indicating seam locations and roll direction in accordance with Section 01 33 00 and 01 78 00. Use mitred transitions when changing directions in layout unless approved otherwise.

1.5 SAMPLES

.1 Submit samples in accordance with Section 01 33 00.

.2 Submit duplicate 300 x 300 mm sample pieces of sheet material, and 300 mm long base.

1.6 MAINTENANCE MATERIALS

.1 Submit extra 5% or to nearest roll of each colour, pattern and type of flooring material and base required for maintenance use. Identify each roll. Store where directed. Submit maintenance material in one piece and of same production run as installed materials.

.2 Deliver to job site in boxes clearly marked with information on contents and include address and date of installation.

.3 Unload and store within building where directed by Departmental Representative.

1.7 ENVIRONMENTAL CHOICE PROGRAM

.1 Provide adhesive products bearing the 'Ecologo' of the Environmental Choice Program, Department of the Environment, Canadian Environmental Protection Act, Environmental Choice Product Guidelines ECP/PCE-44-92 for Adhesives.

.2 Submit one copy of the licensing criteria statements and the verification of compliance with Sections 3(a) and 3(b) of the ECP to the Departmental Representative.

1.8 AIR QUALITY

.1 Select materials and off gas flooring products off site in accordance with CSA B651, including Annex A Environmental Considerations, A.5 Indoor Air Quality and FloorScore certified to SCS-EC10.2-2007.

.2 No detectable odour after installation from flooring, adhesive or accessories.

PART 2 - PRODUCTS

2.1 MATERIALS

.1 Resilient sheet flooring (SH):
.1 Conforming to EN 427 and EN 428.
.2 Resilient plank flooring, fabricated from five layers of construction including sound absorbing back, fill layer, printed layer, clear coating and reinforced UV coating. Flooring to have weather-aged concrete appearance, bevelled dges and smooth texture.
.3 Size: 3 mm thick, in plank sized at 150 x 1200 mm.
.4 Colour: As selected by the Departmental Representative. Provide samples for the Departmental Representative's approval.

.2 Resilient base (RB):
.1 to ASTM F1861, Type TP rubber thermoplastic, Group 1 solid homegeneous, 100mm high, continuous, standard toe profile.
.2 Colour: As selected by the Departmental Representative from manufacturer's full colour range.

.3 Primer, cement, and seam adhesive: type recommended by flooring and base manufacturer to suit substrate and installation, Ecologo certified.

.4 Resin welding rod: type recommended by flooring manufacturer.

.5 Cove stick: type recommended by flooring manufacturer.

.6 Sub-floor filler: premixed latex modified cement mixed with water to produce cementitious paste.

.7 Reducing strip: In accordance with Section 09 68 01.

PART 3 - EXECUTION

3.1 SUB-FLOOR TREATMENT

.1 Remove ridges and bumps.

.2 Apply sub-floor filler to low spots and cracks to achieve floor level to a tolerance of 1:500, allow to cure.

.3 Remove dust, old adhesive, paint, dirt, wax, sealer and foreign matter from existing surfaces.

3.2 PREPARATION AND INSTALLATION

.1 Verify condition and dimensions of previously installed Work upon which this Section depends. Report defects to the Departmental Representative. Commencement of Work means acceptance of existing conditions.

.2 Maintain room and material temperature at approximately 20°C for 3 days before laying, and minimum 2 days after laying.

.3 Test subfloor for moisture content in accordance with flooring manufacturer's instructions using the Vaprecision vapour emission test.
.1 Perform moisture condition test in each major area. A minimum of 1 test per 1000 sq. ft., prior to installation. Moisture condition shall not exceed 3 pounds per 1000 sq. ft. per 24 hour day in accordance with the Rubber Manufacturers Association Test Method.

.4 Do not proceed with work until results of moisture condition tests are acceptable.

.5 Prepare floor and install flooring in accordance with flooring manufacturer's instructions.

.6 Flooring shall be installed over subfloors conforming to ASTM F710 for concrete.

.7 Coordinate with applicable Sections as required for Work of this Section.

.8 Resilient sheet flooring:
.1 Install resilient sheet flooring in accordance with manufacturer's written instructions.

3.2 PREPARATION AND INSTALLATION (Cont'd)

.8 Resilient sheet flooring:(Cont'd)

.2 Apply adhesive uniformly using recommended trowel in accordance with flooring manufacturers instructions. Do not spread more adhesive that can be covered by flooring before initial set takes place.

.3 Run sheets in direction of traffic. Double cut sheet joints and continuously seal according to manufacturer's printed instructions. Remove adhesive seepage of seams or surface while adhesive is still wet.

.4 Heat weld seams in accordance with ASTM F1516 and manufacturer's printed instructions.

.5 As installation progresses and after installation, roll flooring with minimum 45 kg roller to ensure full adhesion.

.6 Cut flooring neatly around fixed objects.

.7 Terminate flooring at centreline of door in openings where adjacent floor finish or colour is dissimilar.

.9 Resilient base:

.1 Lay out base to keep number of joints at minimum.

.2 Prior to installing base, fill cracks and irregularities with a filler recommended by base manufacturer.

.3 Set base in adhesive using a 3 kg hand roller, against wall and floor surfaces.

.4 Install straight and level to variation of 1:1000.

.5 Scribe and fit to door frames and other obstructions.

.6 Cope internal corners.

.10 Install reducing strip at exposed edges. Coordinate with Section 09 68 01 as required for installation.

3.3 CLEANING

.1 Clean flooring and base to manufacturer's instructions.

3.4 PROTECTION OF FINISHED WORK

.1 Protect floors from time of final set of adhesive until final inspection.

.2 Prohibit traffic on floor for 48 hours after installation.

.3 Cover surfaces with fibre reinforced, clean, non-staining kraft paper. Secure in position

3.4 PROTECTION OF FINISHED WORK (Cont'd)

.3 (Cont'd)
with gummed tape to prevent drifting. Remove covering when directed by the Departmental Representative.

END

PART 1 - GENERAL

1.1 RELATED SECTIONS

.1 Section 09 65 00: For resilient base for use with carpet tile.

1.2 REFERENCES

.1 American Society for Testing and Materials International, (ASTM):
.1 ASTM D1335-12, Standard Test Method for Tuft Bind of Pile Yarn Floor Coverings.
.2 ASTM E648-10e1, Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source.
.3 ASTM E662 - 13d, Standard Test Method for Specific Optical Density of Smoke Generated by Solid Materials.

.2 Canadian General Standards Board (CGSB):
.1 CANéCGSB 25.20-95, Surface Sealers for Floors.

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

.4 Contract Carpet Manual, Canadian Carpet Institute, (613) 232-7183.

.5 Carpet and Rug Institute www.carpet-rug.org and Canadian Carpet Institute, www.canadiancarpet.org.
.1 CRI Carpet Installation Standard 2011.
.2 CRI Green Label Indoor Air Quality Testing Program.

.6 Environmental Choice Program (ECP):
.1 P/PCE-44-92, Adhesives.

.7 National Fire Protection Association (NFPA):
.1 NFPA 253-2011, Standard Method of Test for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source.

1.3 PRODUCT DATA

.1 Submit product data sheet for each carpet, carpet tile, undercushion, adhesive, concrete floor sealer and Ecologo products in accordance with Section 01 33 00.

.2 For adhesives, indicate VOC in g/L during application and curing.

1.4 SHOP DRAWINGS

.1 Submit shop drawings in accordance with Section 01 33 00.

.2 Indicate carpeted floor areas, carpet selection, pile direction, cross joints, and other details required by the Departmental Representative to clarify work.

1.5 SAMPLES

.1 Submit for Departmental Representative's review, duplicate carpet tile samples in each colour and type selected in accordance with Section 01 33 00.

1.6 DESIGN DATA, TEST REPORTS, CERTIFICATES, MANUFACTURER'S INSTRUCTIONS AND FIELD REPORTS

.1 Submit evidence of prequalification compliance.

.2 Submit a report by an independent testing laboratory verifying tuft bind meets requirements specified when tested to ASTM D1335.

.3 Submit WHMIS MSDS - Material Safety Data Sheets acceptable to Labour Canada and Health Canada for carpet adhesive and seam cement. Indicate VOC content.

1.7 MAINTENANCE DATA

.1 Provide maintenance data for carpet tile for incorporation into Operation and Maintenance Manual specified in Section 01 78 00.

1.8 MAINTENANCE MATERIALS

.1 Deliver extra 3% of each type, pattern and colour of carpet tile required for this project for maintenance use. Identify each roll. Store where directed.

.2 Maintenance materials to be full size piece of same production run as installed materials.

1.9 AIR QUALITY

.1 Off gas carpet products off site in accordance with CSA B651 including Annex A.

1.10 ENVIRONMENTAL CHOICE PROGRAM

.1 Provide adhesive products bearing the 'Ecologo' of the Environmental Choice Program, Department of the Environment, Canadian Environmental Protection Act, Environmental Choice Product Guidelines ECP/PCE-44 for Adhesives.

1.11 QUALIFICATIONS

.1 Applied by installer trained and certified by carpet tile manufacturer for application of its products.

.2 Manufacturer's representative:
.1 Inspect substrate prior to commencement of work, during application of materials and upon completion of work.
.2 Provide technical assistance to the installer and assist where required in correct installation of carpet tile.

1.12 GUARANTEE

.1 Provide a manufacturer's written material guarantee stating that the carpet tile will remain free of manufacturing defects and deterioration for a period of fifteen years. Non-pro-rated guarantee.

PART 2 - PRODUCTS

2.1 MATERIALS

.1 Carpet tile (CPTT): Carpet tile to meet the following criteria:
.1 Size: 610 x 610 mm.
.2 Fibre content: Nylon.
.3 Fibre weight (tufted): 746 g/sq.m.
.4 Construction: Loop pattern.
.5 Pattern repeat: 60.96 cm x 69.85 cm.
.6 Dye method: Solution dyed.
.7 Gauge: 1/12.
.8 Width: 12' (3.66).
.9 Pile height: 6.35 mm/4.78 mm/3.18 mm.
.10 Total weight: 2323 g/sq.m.
.11 Flammability rating: ASTM E648 and/or NFPA 253, greater than 0.45 watts/CM2 Class 1.
.12 Smoke density: Passes NBS Smoke Chamber Test, ASTM E662.
.13 Colourfasteness: 4.0 or better.
.14 Static rating: Less than 3.0 kV.
.15 Primary backing: Woven polypropylene.
.16 Colour: As selected by the Departmental Representative.

2.1 MATERIALS (Cont'd)

.1 (Cont'd)
.17 Provide samples for the approval of the Departmental Representative.

.2 Rubber base: In accordance with Section 09 65 00.

.3 Carpet tile adhesive:
.1 Non-release type: recommended by carpet tile manufacturer for direct glue down installation, low odour, maximum 20.0g/L or 5% by weight VOCs, free of aromatic solvents, borax, formaldehyde, volatile hydrocarbons such as toluene and mineral spirits, Ecologo certified.

.4 Concrete floor sealer: to CAN/CGSB-25.20, Type 1.

.5 Sub-floor filler: premixed latex mixed with water to produce cementitious paste.

.6 Metal transition strip: Aluminum transition strip having satin anodized finish, complete with a trapezoid-perforated anchoring leg, continuous at all exposed tile edges, depth as required to suit tile thickness.

PART 3 - EXECUTION

3.1 SUB-FLOOR TREATMENT

.1 Remove ridges and bumps.

.2 Apply sub-floor filler to low spots and cracks to achieve floor level to a tolerance of 1:500; allow to cure.

.3 Seal porous and powdery surfaces with concrete floor sealer.

.4 Remove dust, old adhesive, dirt, sealer and wax from existing surfaces.

3.2 INSTALLATION

.1 Install floor carpet in accordance with pattern layout and reviewed shop drawings, manufacturer's printed instructions and in accordance with Contract Carpet Manual, Standard for Installation of Textile Floor covering Materials No. 001.

3.2 INSTALLATION (Cont'd)

.2 Prepare floor surfaces in accordance with CRI Carpet Installation Standard.

.3 Commence work after finishing work is completed.

.4 Ensure toeless type resilient base is installed before proceeding with carpet tile.

.5 Install to CRI Carpet Installation Standard.

.6 Cut and fit around projections through floor.

.7 Finish installation to present smooth wearing surface free from burring or embedded foreign matter.

.8 HEPA Vacuum finished area with commercial grade vacuum with a beater bar head.

.9 Ensure colour, pattern and texture match within any one area.

.10 Fit carpet tile tight to abutting vertical surfaces.

.11 Install trim to be placed under carpet tile in locations indicated on Drawings.

3.3 CARPET TILE

.1 Apply adhesive and install carpet tile in accordance with manufacturer's instructions with acrylic release type adhesive.

.2 Lay tiles with seams within manufacturer's tolerances.

3.4 RESILIENT BASE

.1 In accordance with Section 09 65 00.

3.5 PROTECTION OF FINISHED WORK

.1 Vacuum carpets clean. Protect traffic areas of carpeted floors with acceptable covering.

.2 Remove protective covering when directed by Departmental Representative.

END

PART 1 - GENERAL

1.1 REFERENCES

.1 Architectural Painting Specifications Manual, Master Painters Institute (MPI).

.2 Systems and Specifications Manual, SSPC Painting Manual, Volume Two, Society for Protective Coatings (SSPC).

.3 Test Method for Measuring Total Volatile Organic Compound Content of Consumer Products, Method 24 (for Surface Coatings) of the Environmental Protection Agency (EPA).

.4 National Fire Code of Canada 2010 (NFC).

1.2 QUALITY ASSURANCE

.1 Contractor shall have a minimum of five years proven satisfactory experience. When requested, provide a list of last three comparable jobs including, job name and location, specifying authority, and project manager.

.2 Qualified journeymen who have a "Tradesman Qualification Certificate of Proficiency" shall be engaged in painting work. Apprentices may be employed provided they work under the direct supervision of a qualified journeyman in accordance with trade regulations.

.3 Conform to latest MPI requirements for interior painting work including preparation and priming.

.4 Materials (primers, paints, coatings, varnishes, stains, lacquers, fillers, thinners, solvents, etc.) shall be in accordance with MPI Painting Specification Manual "Approved Product" listing and shall be from a single manufacturer for each system used.

.5 Other paint materials such as linseed oil, shellac, turpentine, etc. shall be the highest quality product of an approved manufacturer listed in MPI Painting Specification Manual and shall be compatible with other coating materials as required.

.6 Retain purchase orders, invoices and other documents to prove conformance with noted MPI

1.2 QUALITY ASSURANCE (Cont'd)

.6 (Cont'd)
requirements when requested by Departmental Representative.

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

1.3 ENVIRONMENTAL PERFORMANCE REQUIREMENTS

.1 Provide paint products meeting MPI "Environmentally Friendly" E2 rating based on VOC (EPA Method 24) content levels.

.2 Where indoor air quality (odour) is a problem, use only MPI listed materials having a minimum E2 rating.

1.4 INSPECTION REQUIREMENTS

.1 Interior painting and decorating work shall be inspected by a Paint Inspection Agency (inspector) acceptable to the specifying authority and local Painting Contractor's Association. Painting contractor shall notify Paint Inspection Agency a minimum of one week prior to commencement of work and provide a copy of project painting specification, plans and elevation drawings (including pertinent details) as well as a Finish Schedule.

.2 Interior surfaces requiring painting shall be inspected by Paint Inspection Agency who shall notify Departmental Representative and General Contractor in writing of defects or problems, prior to commencing painting work, or after prime coat shows defects in substrate.

.3 Where "special" painting, coating or decorating system applications (i.e. elastomeric coatings) or non-MPI listed products or systems are to be used, paint or coating manufacturer shall provide as part of this work, certification of surfaces and conditions for specific paint or coating system application as well as on site supervision, inspection and approval of their paint or coating system application as required at no additional cost to Owner.

1.5 SCHEDULING OF WORK

.1 Submit work schedule for various stages of painting to Departmental Representative for approval. Submit schedule minimum of 48 hours in advance of proposed operations.

.2 Obtain written authorization from the Departmental Representative for any changes in work schedule.

.3 Schedule painting operations to prevent disruption of occupants in and about the building.

1.6 SUBMITTALS

.1 Submit product data and manufacturer's installation/application instructions for each paint and coating product to be used in accordance with Section 01 33 00.

.2 Submit WHMIS MSDS.- Material Safety Data Sheets in accordance with Sections 01 33 00 and 01 78 00.

.3 Upon completion, submit records of products used. List products in relation to finish system and include the following:
.1 Product name, type and use.
.2 Manufacturer's product number.
.3 Colour numbers.
.4 MPI Environmentally Friendly classification system rating.
.5 Manufacturer's Material Safety Data Sheets (MSDS).

1.7 SAMPLES

.1 Submit full range colour sample chips in accordance with Section 01 33 00. Indicate where colour availability is restricted.

.2 Submit duplicate 200 x 300 mm sample panels of each paint finish with specified paint or coating in colours, gloss/sheen and textures required to MPI Painting Specification Manual standards submitted on the following substrate materials:
.1 3 mm plate steel for finishes over metal surfaces.
.2 13 mm birch plywood for finishes over wood surfaces.
.3 13 mm gypsum board for finishes over gypsum board and other smooth surfaces.

1.7 SAMPLES (Cont'd)

.3 When approved, sample panels shall become acceptable standard of quality for appropriate on-site surface with one of each sample retained on-site.

1.8 QUALITY CONTROL

.1 Provide mock-up in accordance with Section 01 45 00.

.2 When requested by Departmental Representative, prepare and paint designated surface, area, room or item (in each colour scheme) to requirements specified herein, with specified paint or coating showing selected colours, gloss/sheen, textures and workmanship to MPI Painting Specification Manual standards for review and approval. When approved, surface, area, room and/or items shall become acceptable standard of finish quality and workmanship for similar on-site work.

1.9 EXTRA MATERIALS

.1 Submit maintenance materials in accordance with Section 01 78 00.

.2 Submit one - four litre can of each type and colour of primer and finish coating. Identify colour and paint type in relation to established colour schedule and finish system.

.3 Deliver to Contractor and store where directed.

1.10 DELIVERY, HANDLING AND STORAGE

.1 Deliver, store and handle materials in accordance with Section 01 61 00.

.2 Labels shall clearly indicate:
.1 Manufacturer's name and address.
.2 Type of paint or coating.
.3 Compliance with applicable standard.
.4 Colour number in accordance with established colour schedule.

.3 Remove damaged, opened and rejected materials from site.

.4 Provide and maintain dry, temperature controlled, secure storage.

.5 Observe manufacturer's recommendations for storage and handling.

1.10 DELIVERY, HANDLING AND STORAGE (Cont'd)

.6 Store materials and supplies away from heat generating devices.

.7 Store materials and equipment in a well ventilated area with temperature range 7°C to 30°C.

.8 Store temperature sensitive products above minimum temperature as recommended by manufacturer.

.9 Keep areas used for storage, cleaning and preparation, clean and orderly to approval of the Departmental Representative. After completion of operations, return areas to clean condition to approval of Departmental Representative.

.10 Remove paint materials from storage only in quantities required for same day use.

.11 Comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling storage, and disposal of hazardous materials.

.12 Fire Safety Requirements:
.1 Provide one 9 kg Type ABC fire extinguisher adjacent to storage area.
.2 Store oily rags, waste products, empty containers and materials subject to spontaneous combustion in ULC approved, sealed containers and remove from site on a daily basis.
.3 Handle, store, use and dispose of flammable and combustible materials in accordance with the National Fire Code of Canada.

1.11 SITE REQUIREMENTS

.1 Heating, Ventilation and Lighting:
.1 Ventilate enclosed spaces.
.2 Perform no painting work unless adequate and continuous ventilation and sufficient heating facilities are in place to maintain ambient air and substrate temperatures above 10°C for 24 hours before, during and after paint application until paint has cured sufficiently.
.3 Where required, provide continuous ventilation for seven days after completion of application of paint.
.4 Coordinate use of existing ventilation system with the Departmental Representative

1.11 SITE REQUIREMENTS (Cont'd)

.1 (Cont'd)

.4 (Cont'd)

and ensure its operation during and after application of paint as required.

.5 Provide temporary ventilating and heating equipment where permanent facilities are not available or supplemental ventilating and heating equipment if ventilation and heating from existing system is inadequate to meet minimum requirements.

.6 Perform no painting work unless a minimum lighting level of 323 Lux is provided on surfaces to be painted. Adequate lighting facilities shall be provided by Contractor.

.2 Temperature, Humidity and Substrate Moisture Content Levels:

.1 Unless specifically pre-approved by the specifying body, Paint Inspection Agency and the applied product manufacturer, perform no painting work when:

.1 Ambient air and substrate temperatures are below 10°C.

.2 Substrate temperature is over 32°C unless paint is specifically formulated for application at high temperatures.

.3 Substrate and ambient air temperatures are expected to fall outside MPI or paint manufacturer's prescribed limits.

.4 The relative humidity is above 85% or when the dew point is less than 3°C variance between the air/surface temperature.

.5 Rain or snow are forecast to occur before paint has thoroughly cured or when it is foggy, misty, raining or snowing at site.

.2 Perform no painting work when the maximum moisture content of the substrate exceeds:

.1 15% for wood.

.2 12% for plaster and gypsum board.

.3 Conduct moisture tests using a properly calibrated electronic Moisture Meter, except test concrete floors for moisture using a simple "cover patch test".

.4 Test concrete, masonry and plaster surfaces for alkalinity as required.

.3 Surface and Environmental Conditions:

.1 Apply paint finish only in areas where dust is no longer being generated by related construction operations or when wind or ventilation conditions are such that airborne

1.11 SITE REQUIREMENTS (Cont'd)

.3 (Cont'd)
.1 (Cont'd)
particles will not affect quality of finished surface.
.2 Apply paint only to adequately prepared surfaces and to surfaces within moisture limits noted herein.
.3 Apply paint only when previous coat of paint is dry or adequately cured.

.4 Additional Interior Application Requirements:
.1 Apply paint finishes only when temperature at location of installation can be satisfactorily maintained within manufacturer's recommendations.
.2 Apply paint in occupied facilities during silent hours only. Schedule operations to approval of Owner such that painted surfaces will have dried and cured sufficiently before occupants are affected.

1.12 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Section 01 74 20.

.2 Paint, stain and wood preservative finishes and related materials (thinners, solvents, etc.,) are regarded as hazardous products and are subject to regulations for disposal. Information on these controls can be obtained from Provincial Ministries of Environment and Regional levels of Government.

.3 Material which cannot be reused must be treated as hazardous waste and disposed of in an appropriate manner.

.4 Place materials defined as hazardous or toxic waste, including used sealant and adhesive tubes and containers, in containers or areas designated for hazardous waste.

.5 To reduce the amount of contaminants entering waterways, sanitary/storm drain systems or into ground the following procedures shall be strictly adhered to:
.1 Retain cleaning water for water-based materials to allow sediments to be filtered out.
.2 Retain cleaners, thinners, solvents and excess paint and place in designated containers and ensure proper disposal.
.3 Return solvent and oil soaked rags used during painting operations for contaminant

1.12 WASTE MANAGEMENT AND DISPOSAL (Cont'd)

.5 (Cont'd)
.3 (Cont'd)
recovery, proper disposal, or appropriate cleaning and laundering.
.4 Dispose of contaminants in an approved legal manner in accordance with hazardous waste regulations.
.5 Empty paint cans are to be dry prior to disposal or recycling (where available).

.6 Where paint recycling is available, collect waste paint by type and provide for delivery to recycling or collection facility.

.7 Set aside and protect surplus and uncontaminated finish materials: Deliver to or arrange collection by individuals or organizations for verifiable re-use or re-manufacturing.

.8 Close and seal tightly partly used sealant and adhesive containers and store protected in well ventilated fire-safe area at moderate temperature.

PART 2 - PRODUCTS

2.1 MATERIALS

.1 Paint materials listed in the MPI Approved Products List (APL) are acceptable for use on this project.

.2 Paint materials for paint systems shall be products of a single manufacturer.

.3 Only qualified products with E2 "Environmentally Friendly" rating are acceptable for use on this project.

.4 Paints, coatings, adhesives, solvents, cleaners, lubricants, and other fluids, shall:
.1 be water-based.
.2 be non-flammable.
.3 be manufactured without compounds which contribute to ozone depletion in the upper atmosphere.
.4 be manufactured without compounds which contribute to smog in the lower atmosphere.

.5 Water-borne surface coatings must be manufactured and transported in a manner that steps of process, including disposal of waste products arising therefrom, will meet

2.1 MATERIALS (Cont'd)

.5 (Cont'd)
requirements of applicable governmental acts, by-laws and regulations including, for facilities located in Canada, Fisheries Act and Canadian Environmental Protection Act (CEPA).

.6 Water-borne surface coatings must not be formulated or manufactured with aromatic solvents, formaldehyde, halogenated solvents, mercury, lead, cadmium, hexavelant chromium or their compounds.

.7 Water-borne surface coatings and recycled water-borne surface coatings must have a flash point of 61.0°C or greater.

.8 Both water-borne surface coatings and recycled water-borne surface coatings must be made by a process that does not release:
.1 Matter in undiluted production plant effluent generating a 'Biochemical Oxygen Demand' (BOD) in excess of 15 mg/L to a natural watercourse or a sewage treatment facility lacking secondary treatment.
.2 Total Suspended Solids (TSS) in undiluted production plant effluent in excess of 15 mg/L to a natural watercourse or a sewage treatment facility lacking secondary treatment.

.9 Water-borne paints and stains, recycled water-borne surface coatings and water borne varnishes must meet a minimum "Environmentally Friendly" E2 rating.

.10 Recycled water-borne surface coatings must contain 50% post-consumer material by volume.

.11 Recycled water-borne surface coatings must not contain:
.1 Lead in excess of 600.0 ppm weight/weight total solids.
.2 Mercury in excess of 50.0 ppm weight/weight total product.
.3 Cadmium in excess of 1.0 ppm weight/weight total product.
.4 Hexavelant chromium in excess of 3.0 ppm weight/weight total product.
.5 Organochlorines or polychlorinated biphenyls (PCBS) in excess of 1.0 ppm weight/weight total product.

.12 The following must be performed on each batch of consolidated post-consumer material before

2.1 MATERIALS (Cont'd)

.12 (Cont'd)
surface coating is reformulated and canned. These tests must be performed at a laboratory or facility which has been accredited by the Standards Council of Canada.
.1 Lead, cadmium and chromium are to be determined using ICP-AES (Inductively Coupled Plasma - Atomic Emission Spectroscopy) technique no. 6010 as defined in EPA SW-846.
.2 Mercury is to be determined by Cold Vapour Atomic Absorption Spectroscopy using Technique no. 7471 as defined in EPA SW-846.
.3 Organochlorines and PCBs are to be determined by Gas Chromatography using Technique no. 8081 as defined in EPA SW-846.

2.2 COLOURS

.1 Paint types (PT): Refer to selected colour references for work of this Section. Departmental Representative will select choice of gloss when compiling a Gloss Schedule after Award of Contract.

.2 Selection of colours will be from manufacturers full range of colours.

.3 Where specific products are available in a restricted range of colours, selection will be based on the limited range.

.4 Second coat in a three coat system to be tinted slightly lighter colour than top coat to show visible difference between coats.

2.3 MIXING AND TINTING

.1 Perform colour tinting operations prior to delivery of paint to site. On-site tinting of painting materials is allowed only with Departmental Representative's written permission.

.2 Paste, powder or catalyzed paint mixes shall be mixed in strict accordance with manufacturer's written instructions.

.3 Where thinner is used, addition shall not exceed paint manufacturer's recommendations. Do not use kerosene or any such organic solvents to thin water-based paints.

.4 Thin paint for spraying according in strict accordance with paint manufacturer's instructions. If directions are not on

2.3 MIXING AND TINTING (Cont'd)

.4 (Cont'd)
container, obtain instructions in writing from manufacturer and provide copy of instructions to Departmental Representative.

.5 Re-mix paint in containers prior to and during application to ensure break-up of lumps, complete dispersion of settled pigment, and colour and gloss uniformity.

2.4 GLOSS/SHEEN RATINGS

.1 Paint gloss shall be defined as the sheen rating of applied paint, in accordance with the following values:

Gloss Level Category	Units @ 60°	Units @ 85°
G1 - matte finish	0 to 5	max. 10
G2 - velvet finish	0 to 10	10 to 35
G3 - eggshell finish	10 to 25	10 to 35
G4 - satin finish	20 to 35	min. 35
G5 - semi-gloss finish	35 to 70	
G6 - gloss finish	70 to 85	
G7 - high gloss finish	> 85	

.2 Gloss level ratings of painted surfaces to be as selected by the Departmental Representative.

2.5 INTERIOR PAINTING SYSTEMS

.1 Structural Steel and Metal Fabrications:
.1 INT 5.1R High performance architectural latex finish. Gloss level as selected by the Departmental Representative.

.2 Galvanized Metal: Misc. steel, pipes, ducts, etc.
.1 INT 5.3A Latex. Gloss level as selected by the Departmental Representative.

.2 Galvanized Metal: Doors and frames, etc.
.1 INT 5.3M High performance architectural latex. Gloss level as selected by the Departmental Representative.

2.5 INTERIOR PAINTING SYSTEMS (Cont'd)

.3 Dressed lumber: Wood doors.
.1 INT 6.3B Waterborne alkyd. Gloss level as selected by the Departmental Representative.

.3 Plastics: vinyl faced gypsum board.
.1 INT 6.8A High performance architectural latex. Gloss level as selected by the Departmental Representative.

.3 Gypsum Board: gypsum wallboard, drywall, "sheet rock type material", etc., and textured finishes
.1 INT 9.2A Latex finish (over latex sealer).
.2 Gloss levels as selected by the Departmental Representative.

PART 3 - EXECUTION

3.1 GENERAL

.1 Perform preparation and operations for interior painting in accordance with MPI Painting Specifications Manual except where specified otherwise.

.2 Apply paint materials in accordance with paint manufacturer's written application instructions.

3.2 EXISTING SURFACES

.1 Remove all rust, scale, loose paint and other deleterious matters from surface of existing walls, ceilings, doors, frames, glazing stops, structural and miscellaneous steel, and other existing surfaces which require re-painting. Thoroughly clean and prepare such surfaces to accept positive and permanent bond of new paint finish. If such preparation exposes bare surface, provide touch up primer.

3.3 EXISTING CONDITIONS

.1 Investigate existing substrates for problems related to proper and complete preparation of surfaces to be painted. Report to Departmental Representative damages, defects, unsatisfactory or unfavourable conditions before proceeding with work.

.2 Conduct moisture testing of surfaces to be painted using a properly calibrated electronic

3.3 EXISTING CONDITIONS (Cont'd)

.2 (Cont'd)
moisture meter, except test concrete floors for moisture using a simple "cover patch test" and report findings to Departmental Representative. Do not proceed with work until conditions fall within acceptable range as recommended by manufacturer.

.3 Maximum moisture content as follows:
.1 Gypsum Board: 12%.

3.4 PROTECTION

.1 Protect existing building surfaces and adjacent structures from paint spatters, markings and other damage by suitable non-staining covers or masking. If damaged, clean and restore such surfaces as directed by Departmental Representative.

.2 Protect items that are permanently attached such as Fire Labels on doors and frames.

.3 Protect factory finished products and equipment.

.4 Protect building occupants in and about the building.

.5 Removal of electrical cover plates, light fixtures, surface hardware on doors, bath accessories and other surface mounted equipment, fittings and fastenings shall be done prior to undertaking any painting operations by General Contractor. Items shall be securely stored and re-installed after painting is completed by General Contractor.

.6 As painting operations progress, place "WET PAINT" signs in occupied areas to approval of Departmental Representative.

3.5 CLEANING AND PREPARATION

.1 Clean and prepare surfaces in accordance with MPI Painting Specification Manual requirements. Refer to MPI Manual in regard to specific requirements and as follows:
.1 Remove dust, dirt, and other surface debris by vacuuming, wiping with dry, clean cloths.
.2 Wash surfaces with a biodegradable detergent and clean warm water using a stiff bristle brush to remove dirt, oil and other surface contaminants.

3.5 CLEANING AND PREPARATION (Cont'd)

.1 (Cont'd)

.3 Rinse scrubbed surfaces with clean water until foreign matter is flushed from surface.

.4 Allow surfaces to drain completely and allow to dry thoroughly.

.5 Prepare surfaces for water-based painting, water-based cleaners should be used in place of organic solvents.

.6 Use trigger operated spray nozzles for water hoses.

.7 Many water-based paints cannot be removed with water once dried. However, minimize the use of kerosene or any such organic solvents to clean up water-based paints.

.2 Prevent contamination of cleaned surfaces by salts, acids, alkalis, other corrosive chemicals, grease, oil and solvents before prime coat is applied and between applications of remaining coats. Apply primer, paint, or pretreatment as soon as possible after cleaning and before deterioration occurs.

.3 Where possible, prime surfaces of new wood surfaces before installation. Use same primers as specified for exposed surfaces.

.1 Apply vinyl sealer to MPI #36 over knots, pitch, sap and resinous areas.

.2 Apply wood filler to nail holes and cracks.

.3 Tint filler to match stains for stained woodwork.

.4 Sand and dust between coats as required to provide adequate adhesion for next coat and to remove defects visible from a distance up to 1000 mm.

.5 Clean metal surfaces to be painted by removing rust, loose mill scale, welding slag, dirt, oil, grease and other foreign substances in accordance with MPI requirements. Remove traces of blast products from surfaces, pockets and corners to be painted by brushing with clean brushes or vacuum cleaning.

.6 Touch up of shop primers with primer as specified in applicable section. Major touch-up including cleaning and painting of field connections, welds, rivets, nuts, washers, bolts, and damaged or defective paint and rusted areas, shall be by supplier of fabricated material.

3.5 CLEANING AND PREPARATION (Cont'd)

.7 Do not apply paint until prepared surfaces have been accepted by Departmental Representative.

3.6 APPLICATION

.1 Method of application to be as approved by Departmental Representative. Apply paint by brush or roller. Conform to manufacturer's application instructions unless specified otherwise.

.2 Brush and Roller Application:
.1 Apply paint in a uniform layer using brush and/or roller of types suitable for application.
.2 Work paint into cracks, crevices and corners.
.3 Paint surfaces and corners not accessible to brush using spray, daubers and/or sheepskins. Paint surfaces and corners not accessible to roller using brush, daubers or sheepskins.
.4 Brush and/or roll out runs and sags, and over-lap marks. Rolled surfaces shall be free of roller tracking and heavy stipple unless approved by Departmental Representative.
.5 Remove runs, sags and brush marks from finished work and repaint.

.3 Use dipping, sheepskins or daubers only when no other method is practical in places of difficult access and only when specifically authorized by. Departmental Representative.

.4 Apply coats of paint as a continuous film of uniform thickness. Repaint thin spots or bare areas before next coat of paint is applied.

.5 Allow surfaces to dry and properly cure after cleaning and between subsequent coats for minimum time period as recommended by manufacturer.

.6 Sand and dust between coats to remove visible defects.

.7 Finish surfaces both above and below sight lines as specified for surrounding surfaces, including such surfaces as tops of interior cupboards and cabinets and projecting ledges.

.8 All doors to be painted smooth without brush or roller marks.

3.6 APPLICATION (Cont'd)

.9 Finish top, bottom, edges and cutouts of doors after fitting as specified for door surfaces.

3.7 MECHANICAL/ ELECTRICAL EQUIPMENT

.1 Unless otherwise specified, paint finished area exposed conduits, piping, hangers, ductwork and other mechanical and electrical equipment with colour and finish to match adjacent surfaces, except as noted otherwise.

.2 Boiler room, mechanical and electrical rooms: paint exposed conduits, piping, hangers, ductwork and other mechanical and electrical equipment.

.3 Other unfinished areas: leave exposed conduits, piping, hangers, ductwork and other mechanical and electrical equipment in original finish and touch up scratches and marks.

.4 Touch up scratches and marks on factory painted finishes and equipment with paint as supplied by manufacturer of equipment.

.5 Do not paint over nameplates.

.6 Keep sprinkler heads free of paint.

.7 Paint inside of ductwork where visible behind grilles, registers and diffusers with primer and one coat of matt black paint.

.8 Paint fire protection piping red, unless otherwise indicated.

.9 Paint disconnect switches for fire alarm system and exit light systems in red enamel.

.10 Paint natural gas piping yellow, unless otherwise indicated.

.11 Paint both sides and edges of backboards for telephone and electrical equipment before installation. Leave equipment in original finish except for touch-up as required, and paint conduits, mounting accessories and other unfinished items.

.12 Do not paint interior transformers and substation equipment.

3.8 FIELD QUALITY CONTROL

.1 Field inspection of painting operations to be carried out be independent inspection firm as designated by Departmental Representative.

.2 Advise Departmental Representative when surfaces and applied coating is ready for inspection. Do not proceed with subsequent coats until previous coat has been approved.

.3 Co-operate with inspection firm and provide access to areas of work.

3.9 RESTORATION

.1 Clean and re-install all hardware items removed before undertaken painting operations.

.2 Remove protective coverings and warning signs as soon as practical after operations cease.

.3 Remove paint splashings on exposed surfaces that were not painted. Remove smears and spatter immediately as operations progress, using compatible solvent.

.4 Protect freshly completed surfaces from paint droppings and dust to approval of Departmental Representative. Avoid scuffing newly applied paint.

.5 Restore areas used for storage, cleaning, mixing and handling of paint to clean condition as approved by Departmental Representative.

END

PART 1 - GENERAL

1.1 REFERENCES

.1 American Architectural Manufacturers Association:
.1 AAMA 611-12, Voluntary Specification for Anodized Architectural Aluminum.

.2 ASTM International
.1 ASTM A653/A653M-11, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
.2 ASTM B221-13, Standard Specification for Aluminum and Aluminum Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
.3 ASTM C645-13, Standard Specification for Nonstructural Steel Framing Members.
.4 ASTM C1396/C1396M-13, Standard Specification for Gypsum Board.
.5 ASTM E90-09, Standard Test Method for Laboratory Measurement of Airborne - Sound Transmission Loss of Building Partitions, and Elements.
.6 ASTM E2638-10, Standard Test Method for Objective Measurement of the Speech Privacy Provided by a Closed Room.

1.2 DESIGN REQUIREMENTS

.1 Demountable partition system to be width as indicated, with flush joints, system components, door frames, wood doors, glazed openings, resilient base and all trim components.

.2 Basic system to be ceiling height partitions, from single manufacturer, of metal stud type framing faced with removable gypsum board faced panels both sides.

.3 Partition assembly: Non-combustible construction, fire resistance rated, fully demountable and relocatable, extend in four directions without disturbing other panels, accommodate floor and ceiling height variations of 25 mm.

.4 Components to be distortion free, uniform in dimension, construction and appearance, made to suit specific function and to have been proven in use.

1.2 DESIGN REQUIREMENTS (Cont'd)

.5 Partition heights: As indicated.

.6 Partition module: As indicated.

.7 Minimum sound transmission rating of installed panel partition to be meet desired STC rating, tested to ASTM E90.

.8 Minimum speech privacy category SPC to meet desired privacy rating, tested to ASTM E2638.

.9 Partition system to accommodate electrical, telephone, wiring and outlets as required for Work of this Project.

.10 Design partition system to allow for all panels to be point accessible without affecting adjoining panels.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00.

.2 Product Data:
.1 Submit manufacturer's printed product literatureand data sheets for demountable partitions and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Samples:
.1 Submit one representative model of partition.
.1 Indicate basic construction, glazed sections, door frames, trim, and finishes.
.2 Submit duplicate 200 x 300 mm samples of panel colours, textures and finishes and 300 mm long samples of trim options for colour selection by Departmental Representative.
.3 Submit sample of ceiling fixing device.

.4 Test Reports:
.1 Submit test reports in accordance with Section 01 33 00, from approved independent testing laboratory, certifying partition system complies with sound transmission rating, and fire hazard classification as specified.

1.4 QUALITY ASSURANCE

.1 Installers qualifications: Perform Work of this Section by a company that has a minimum of five years proven experience in the installation of demountable partition systems of a similar size and nature and that is approved by manufacturer. Submit to Departmental Representative, installer's current certificate of approval by the material manufacturer as proof of compliance.

.2 Mock-ups:
.1 Construct mock-ups in accordance with Section 01 45 00.
.2 Erect assembly of two modules of partition, on site where directed by Departmental Representative.

1.5 DELIVERY, STORAGE AND HANDLING

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

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

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

.4 Packaging Waste Management: remove for reuse and return pallets, crates, padding and packaging materials as specified in in accordance with Section 01 74 20.

1.6 WARRANTY

.1 For demountable partitions specified in this Section 10 22 19 the 12 month warranty period prescribed in General Conditions is extended to five years.

PART 2 - PRODUCTS

2.1 MATERIALS

.1 Stud type demountable partition.

.2 Stud framing: To ASTM C645, stud size as indicated on Contract Drawings, designed and prepared for removable attachment of facing sheets.

.3 Aluminum extrusions: ASTM B221, aluminum Association alloy AA 6063-T5.

.4 Galvanized steel sheet: furniture grade to ASTM A653/A653M with Z275 zinc coating.

.5 Vinyl faced gypsum board: Conforming to ASTM C1396, 12.7 mm thick, unless otherwise indicated, in vinyl facing colour as selected by the Departmental Representative.

.6 Plain gypsum board: Conforming to ASTM C1396, standard gypsum board, 12.7 mm thick, unless otherwise indicated, ends square cut, edges square.

.7 Acoustical insulation and sealant: Type recommended by partition manufacturer to achieve STC rating specified.

.8 Sound/light seal: Self-adhesive, closed cell, inorganic, permanently elastic sponge type neoprene strips, minimum 12 mm thick.

.9 Glass and glazing materials: to Section 08 80 00.

.10 Doors and hardware:
.1 Wood doors: In accordance with Section 08 14 11.
.2 Doors are to be factory prepared to receive specified hardware as per Section 08 71 11.

.11 Resilient base: In accordance with Section 09 65 00.

2.2 COMPONENTS

.1 General: Provide all components and accessories as required for the complete and secure installation of the demountable partition systems.

2.2 COMPONENTS (Cont'd)

.2 General framing and retaining components: extruded aluminum. Metal thickness and configuration to provide rigidity, safe support and fixing of partition system.

.3 Panels: vinyl faced gypsum board.

.4 Glazing frames: extruded aluminum, for single glazing. unless otherwise indicated or

required to meet desired STC ratings.
.1 Prepare for glazing specified in Section 08 80 00.

.5 Door frames: extruded aluminum for doors as indicated on Contract Drawings, with adjustable stops.
.1 Prepare for hardware provided by Section 08 71 11.

.6 Wood doors: Coordinate with Section 08 14 11 as required for the sizing and installation of wood doors in demountable partitions.

.7 Partition top rail: extruded aluminum cap.

.8 Partition base: Coordinate with Section 09 65 00 as required for the sizing and installation of the resilient base.

.9 Accessories: Provide all accessories as required for the complete and secure installation of demountable partitions including but not limited to miscellaneous trim, bracing, fasteners, clips, and other accessories required for the installation as recommended by partition manufacturer.

.10 Furniture supports: Manufacturer's standard for support of cabinetry manufactured by standard furniture system companies.

2.3 FABRICATION

.1 Fabricate demountable partition system in accordance with reviewed shop drawings and manufacturer's written instructions.

2.4 FINISHES

.1 Aluminum:
.1 Finish exposed surfaces of aluminum components in accordance with Aluminum Association Designation System for Aluminum Finishes.

2.4 FINISHES (Cont'd)

.1 Aluminum:(Cont'd)
.2 Clear anodic finish: Designation AA-M12C22A41.
.3 Appearance and properties of anodized finishes designated by Aluminum Association as Architectural Class 1, Architectural Class 2, and Protective and Decorative.

.2 Vinyl facing: Vinyl facing in colour as selected by the Departmental Representative.

.3 Steel: Epoxy powder coat finish in colour as selected by the Departmental Representative.

PART 3 - EXECUTION

3.1 EXAMINATION

.1 Verification of Conditions: verify conditions of substrates and surfaces to receive post and panel demountable partitions previously installed under other Sections or Contracts are acceptable for product installation in accordance with manufacturer's instructions.
.1 Visually inspect substrate in presence of Departmental Representative.
.2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval from Departmental Representative.

3.2 ERECTION

.1 Install demountable partition system in accordance with reviewed shop drawings and manufacturer's instructions.

.2 Coordinate with applicable Sections as required for Work of this Section.

.3 Fasten runners to floors, ceiling and abutting vertical surfaces at 600 mm on centre.
.1 At ceilings use fasteners that rigidly support partition without damaging or defacing ceiling panels or grid system members.

.4 Erect partitions plumb, square and level.
.1 Accurately fit and fasten to abutting surfaces.

3.2 ERECTION (Cont'd)

.4 (Cont'd)
.2 Shim under partitions at uneven floors to ensure level installation.

.5 Brace studs at 1200 mm on centre

.6 Provide sound seal in continuous lengths between partition and permanent members, such as at junction of ceiling height partitions with floors, ceilings and abutting walls and vertical surfaces.

.7 Install acoustical insulation and sealant in sound rated partitions to correspond with tested assembly.
.1 Install panels and sealant in accordance with manufacturer's printed instructions. Apply panels full height floor to ceiling.

.8 Coordinate with mechanical and electrical trades for all services required to be built into partition system.

.9 Doors and hardware:
.1 Coordinate with Section 08 14 11 as required for the installation of wood doors.
.2 Install doors and hardware in accordance with manufacturer's written instructions.
.3 Adjust doors and hardware as required for smooth and efficient operation.

.10 Glaze partitions in accordance with Section 08 80 00.

.11 Resilient base: Coordinate with Section 09 65 00 as required for the installation of resilient bases.

.12 Seal partitions in accordance with Section 07 90 00.

.13 The complete installation shall be free of exposed screws or other fasteners, with surfaces free of tool marks, scratches or any other marred surface detrimental to appearance.

3.3 ADJUSTING

.1 Adjust demountable partitions fit accurately in accordance with manufacturer's written recommendations.

3.4 CLEANING

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

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

.3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 20.
.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.5 PROTECTION

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

.2 Repair damage to adjacent materials caused by demountable partitions installation.

END

PART 1 - GENERAL

1.1 RELATED SECTIONS

.1 Section 06 10 12: Carpentry.

1.2 REFERENCES

.1 American National Standards Institute (ANSI):
.1 ANSI A208.1-2009, Particleboard.

.2 ASTM International:
.1 ASTM A490-12, Standard Specification for Structural Bolts, Alloy Steel, Heat Treated, 150 ksi Minimum Tensile Strength.
.2 ASTM D523-08, Standard Test Method for Specular Gloss.
.3 ASTM D968-05(2010), Standard Test Methods for Abrasion Resistance of Organic Coatings by Falling Abrasive.

.3 Canadian General Standards Board (CGSB):
.1 CAN/CGSB-1.181-99, Ready-Mixed OrganicZinc-Rich Coating.

.4 Canadian Standards Association (CSA):
.1 CSA B651-12, Accessible Design for the Built Environment.
.2 CSA G40.20-04(2009)/G40.21-04(R2009), General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
.3 CAN/CSA-W59-03(R2008), Welded SteelConstruction (Metal Arc Welding).

.5 Mobile Shelving - Fire Protection Design Requirements 2002-11-04, HRDC Fire Commisioner of Canada.

.6 The Master Painters Institute (MPI) /MPI #79 - Primer, Alkyd, The Master Painters Institute (MPI)Anti-Corrosive for Metal. /Architectural Painting Specification Manual,latest edition.

1.3 DEFINITIONS

.1 Bay: a single shelving section of a unit.

.2 Unit: an assembly of one or more bays.

.3 Module/array: a grouping of units with one or more access.

1.3 DEFINITIONS (Cont'd)

.4 System: complete system including units, track, etc.

1.4 DESIGN REQUIREMENTS

.1 Layout of mobile storage shelving to stay within parameters as outlined in report prepared by MTE Consultants Inc. attached to the end of this Document.

1.5 SHOP DRAWINGS AND PRODUCT DATA SHEETS

.1 Submit shop drawings and product data sheets for track type, track installation detail, track and deck assembly, stationary tie down detail, rubber bumpers, drive upright detail, carriage detail including splice, control pad, and accessories in accordance with Section 01 33 00.

.2 Indicate manufacturer's name, product code, dimensions, layout, number of bays, number of shelves, number and size of drawers and bins, number of dividers, system of bracing against tipping and anchoring devices.

1.6 DESIGN CRITERIA

.1 Track/rail system: design and construct track/rail system flush with floor for barrier free access with no visible gaps between track and adjacent flooring. Design and construct low profile track to support minimum load 1491 kg per m.

.2 Carriage: design to support a minimum load of 1491 kg per m. Double gear reduction to allow carriage to move 0.45 kg of effort at turn handle. Provide manual safety lock to prevent carriages from being moved while personnel access open aisle.

.3 Shelving: four post, wedge-locking design, consisting of uprights, shelves and shelf supports, assembled without nuts, bolts, studs, clips, sway braces or gussets. No holes on any exposed surfaces of assembled shelving. All shelves and backs flush with outside post. Provide sheet metal gables and back between each bay of shelves to prevent tampering from adjacent units.
.1 Individual shelves designed to support a uniform load of 128 kg per m. of span.
.2 Adjustment: provide for easy assembly, expansion, dismantling and re-use of shelving

1.6 DESIGN CRITERIA (Cont'd)

.3 Shelving:(Cont'd)

.2 Adjustment:(Cont'd)

components. Provide for vertical adjustment of shelves in 38 mm increments.

1.7 SAMPLES

.1 Submit samples in accordance with Section 01 33 00.

.2 Submit representative sample bay of specified shelving showing finish colour and accessories.

1.8 WARRANTY

.1 Submit an extended warranty for 10 years for materials and labour.

PART 2 - PRODUCTS

2.1 MATERIALS

.1 All materials and components from same manufacturer.

.2 Steel sections and plates: to CSA G40.20/G40.21, type 400W, minimum 25% recycled content.

.3 Steel: to CSA G40.20/G40.21, Grade 300W, minimum 25% recycled content.

.4 Hollow Structural Sections (HSS): to CSA G40.20-04/G40.21, Grade 350W, Class H, minimum 25% recycled content.

.5 Alkyd primer: to Master Painters Institute MPI# 79 - Primer, Alkyd, Anti-Corrosive for Metal. Ecologo certified.

.6 Zinc rich primer for galvanized surfaces: zinc rich, ready mix to CAN/CGSB-1.181, Ecologo certified.

.7 Steel bolts, nuts and washers: to ASTM A490.

.8 Welding materials: to CSA W59.

.9 Aluminium: extrusions to Aluminium Association Designation AA 6063 in finish Designation AA-A31 clear.

2.1 MATERIALS (Cont'd)

.10 Anchoring and grouting mortar: quick setting hydraulic cement.

.11 Melamine prefinished laminated plastic panels: panels consisting of 0.178 mm thick melamine resin impregnated decorative sheet thermally fused to rigid particleboard substrate. Particleboard substrate to ANSI A208.1.

2.2 FABRICATION

.1 Track and raised floor:

.1 Tracks shall be designed to be securely connected together while allowing for adjustment so tracks can be leveled over an uneven floor.

.2 A 1.9 mm thick level plate required the full length of the track. The lower ends of track leveling screws to rest on plate.

.3 Tracks shall be located, positioned properly and leveled.

.4 Each track shall have a minimum base area of 57 mm with 100 mm steel channel supports on 300 mm centers under the rail.

.5 All track and rail lengths must extend under all stationary ranges.

.6 Levelness of rails equals 1.5 mm maximum variation from true level within any module; 1.5 mm maximum variation between adjacent rails perpendicular to rail direction.

.7 The rail is to be 16 mm square cold-rolled steel. Each section to be a minimum of 2400 mm with shorter sections used only to terminate each individual rail assembly. In addition, each end of the rail overlaps the track housing and is pinned to the track with a 6 mm diameter roll pin.

.8 All rail connection joints shall provide horizontal and vertical continuity between rail simultaneously sharing the wheel point load to and from adjoining rail sections.

.9 The track housing is to be extruded from 6063-T5 aluminum alloy.

.10 The rail fits into a 6 mm recess designed in the aluminum track housing to hold the rail in place and provide alignment for the 16 mm steel rail which overlaps each track splice joint.

.11 Anti-tip (if applicable) track housing shall be extruded from 6005A-T5 aluminum alloy. A mating anti-tip bracket shall be mounted to the underside of the carriage. Overhead anti-tip devices are unacceptable.

2.2 FABRICATION (Cont'd)

.1 (Cont'd)

.12 Track will require no attachment in any manner to the building floor, completely anchorless. All rail and deck components shall be interconnected.

.2 Modular floor:

.1 The deck is to be constructed of 19 mm thickness commercial grade plywood.

.2 Finished flooring shall be flush and level with the top of the rails.

.3 The threshold shall be constructed and finished in a material compatible with the deck.

.4 The ramp shall not extend past the end of the carriage into the main access aisle.

.5 Decking and ramp shall be installed in a manner that will prevent warping, deformation and movement during normal operation and loading.

.6 Deck to be supported by 1.9 mm thick steel support channels placed under the deck leveling bolts at 12" centres shall have a 12 gauge self-adhesive steel base. All leveling bolts must be secured with blue lock tite.

.7 Deck channels to secured and bolted to track assembly at each level bracket assembly location.

.8 Steel leveler bracket assemblies support track extrusions. Each leveler bracket assembly shall be equipped with a pair of leveling bolts for ease of adjustment during installation.

.9 1.5 mm thick stainless steel ramp threshold shall be attached, providing smooth entry from existing floor to system floor.

.10 Deck will require no attachment in any manner to the building floor, completely anchorless. All rail and deck components shall be interconnected.

.3 Carriage:

.1 Carriages are of 2.7 mm thick welded steel construction, designed and manufactured to support 317 kg per linear carriage metre. All carriages are painted and finished with powder coat paint in textured finishes.

.2 Fixed carriages are of the same construction and height as movable carriages and rest on rails and bolted to the track housing for a complete, homogeneous system.

.3 Carriage splices are of a bolted (type) design to maintain proper unit alignment.

.4 Carriage cross members are 2.7 mm thick welded C-shaped steel channels.

2.2 FABRICATION (Cont'd)

.3 Carriage:(Cont'd)

.5 Carriage construction allows shelving to be securely anchored to the carriages.

.6 All wheels are a minimum of 125 mm in diameter, precision ground, balanced and constructed from solid steel for a smooth operation.

.7 A minimum of four guide wheels are provided per movable carriage. Guide wheels are machined with flanges on both sides of the wheel.

.8 Each drive wheel is fitted with two permanently sealed and shielded bearings housed in a self-aligning flanged pillow block.

.9 All mobile carriages are fitted with full-length drive shafts.

.10 All drive shafts are a minimum of 25 mm solid stress proof steel and connect all wheels on drive side of carriage with 6 mm x 50 mm square keys and couplings. All axles are solid steel and support the full load of the carriage.

.4 Mechanical drive specifications:

.1 The mechanical assist handle shall be of a three spoke ergonomic design. The transfer of power from the handle to the drive shaft is chain driven.

.2 All mechanical assist systems are moved by means of a chain and sprocket reduction drive system.

.3 All chains and sprockets are concealed for safety. The gearing mechanism is easily accessible and able to accept different sprockets depending on weight changes.

.4 Dual control options are available permitting operation of mobile carriages from either end of range.

.5 Gear ratio is to be determined by carriage length and weight; factory calculates correct drive effort for each system considering length, weight loads and number of carriages to be moved.

.6 There is no "play" in the drive handle at any time and the carriage will stop without drifting when operation of the handle is terminated on all leveled systems.

.5 Finished end panels:

.1 All optional end panels are full height and depth of the shelving ends.

.2 High-pressure laminate covered end panels are 38 mm thick.

2.2 FABRICATION (Cont'd)

.5 Finished end panels:(Cont'd)
.3 Steel chain covers or end panels 0.9 mm thick are supplied as specified. The chain cover shall cover only the exposed chain drive mechanism while the steel end panel will be the full height and width of the upright.

.6 Safety features:
.1 All carriages are equipped with a push/pull safety handle parking lock as a standard feature. The lock, when engaged, utilizes a (reinforced) dual pin insertion concept that will expose a red indicator to show the carriage is in the lock down mode.
.2 Carriage end stops are provided for systems without stationary units.
.3 A "safety space" is provided between end panels by the use of 19 mm carriage bumpers; this provides protection for the fingers of those using the system and provides a positive stop for all carriages.

.7 Attachment of shelving: Carriage construction is designed to facilitate the secure anchoring of most all shelving styles to the carriages with high performance tek screws.

.8 System features:
.1 Security key lock to secure one carriage or entire system.
.2 Back panels, end caps and miscellaneous finishing pieces.
.3 Two cardholders (for 3 x 5 index cards) are included with each carriage. Four cardholders are supplied for dual access systems.

.9 Ramp: To be fabricated from stainless steel. Ramp must not extend past the front of the units into the main access aisle and slop must not exceed 1:12.

2.3 FINISH

.1 Finish metal shelving in colour selected by Departmental Representative from manufacturer's standard range.

.2 Finish: electrostatic epoxy powder coated.
.1 Electrostatic epoxy powder coated:
.1 Specular gloss value: to ASTM D523.
.2 Abrasion test: to ASTM D968.
.3 Colour: To be selected by the Departmental Representative.

2.3 FINISH (Cont'd)

.3 Manufacturers or brand names acceptable if not prominently displayed.

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Install metal storage shelving in accordance with reviewed layout, installation and start-up instructions.

.2 Installation by factory trained, authorized installer.

.3 Install rail to tolerances of, max 2.4 mm from true level within module, max. 1.6 mm between adjacent rails and max. 0.8 mm in 3048 mm rail length.

.4 Install raised floor deck free of gaps or barriers at track locations. Install ramp to raised floor to meet CSA B651.

.5 Install components in place, plumb, straight and level.

.6 Brace, secure and anchor components in place.

.7 Install shelving at uniform, equal height spacing, unless instructed otherwise.

.8 Make good finished surfaces damaged during shipment or installation.

END

PART 1 - GENERAL

1.1 REFERENCES

.1 National Fire Prevention Association (NFPA)
- .1 NFPA 13-2013, Standard for the Installation of Sprinkler Systems.
- .2 NFPA 20-2010, Standard for the Installation of Stationary Pumps for Fire Protection.
- .3 NFPA 24-2010, Standard for the Installation of Private Fire Service Mains and Their Appurtenances.
- .4 NFPA 25-2008, Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems.

.2 Underwriter's Laboratories of Canada (ULC)
- .1 CAN/ULC-S543-09, Standard for Internal Lug Quick Connect Coupling for Fire Hose.
- .2 CAN/ULC-S543-09-AM1, Amendment 1 to Standard for Internal Lug Quick Connect Coupling for Fire Hose.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00.

.2 Product Data:
- .1 Provide manufacturer's printed product literature and data sheets, and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Shop Drawings:
- .1 Submit drawings stamped and signed by professional engineer registered or licensed in Province of Ontario, Canada.
- .2 Indicate:
  - .1 Materials.
  - .2 Finishes.
  - .3 Method of anchorage
  - .4 Number of anchors.
  - .5 Supports.
  - .6 Reinforcement.
  - .7 Assembly details.
  - .8 Accessories.

.4 Samples:
- .1 Submit samples of following:
  - .1 Each type of sprinkler head.
  - .2 Signs.

1.2 ACTION AND INFORMATIONAL SUBMITTALS (Cont'd)

.5 Test reports:
.1 Submit certified test reports for wet pipe fire protection sprinkler systems from approved independent testing laboratories, indicating compliance with specifications for specified performance characteristics and physical properties.

.6 Certificates:
.1 Submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.7 Manufacturers' Instructions:
.1 Provide manufacturer's installation instructions.

.8 Field Quality Control Submittals:
.1 Manufacturer's Field Reports: manufacturer's field reports specified.

1.3 CLOSEOUT SUBMITTALS

.1 Provide operation, maintenance and engineering data for incorporation into manual specified in Section 01 78 00 in accordance with NFPA 20.

.2 Manufacturer's Catalog Data, including specific model, type, and size for:
.1 Pipe and fittings.
.2 Alarm valves.
.3 Valves, including gate, check, and globe.
.4 Water motor alarms.
.5 Sprinkler heads.
.6 Pipe hangers and supports.
.7 Pressure or flow switch.
.8 Fire department connections.
.9 Excess pressure pump.
.10 Mechanical couplings.

.3 Drawings:
.1 Sprinkler heads and piping system layout.
.1 Prepare 760 mm by 1050 mm detail working drawings of system layout in accordance with NFPA 13, "Working Drawings (Plans)".
.2 Show data essential for proper installation of each system.
.3 Show details, plan view, elevations, and sections of systems supply and piping.
.4 Show piping schematic of systems supply, devices, valves, pipe, and

1.3 CLOSEOUT SUBMITTALS (Cont'd)

.3 Drawings:(Cont'd)
.1 (Cont'd)
.4 (Cont'd)
fittings. Show point to point electrical wiring diagrams.
.2 Electrical wiring diagrams.

.4 Design Data:
.1 Calculations of sprinkler system design.
.2 Indicate type and design of each system and certify that each system has performed satisfactorily in the manner intended for not less than 18 months.

.5 Field Test Reports:
.1 Preliminary tests on piping system.

.6 Records:
.1 As-built drawings and specifications of each system.
.1 After completion, but before final acceptance, submit complete set of as-built drawings of each system for record purposes.
.2 Submit 760 mm by 1050 mm drawings with title block similar to full size contract drawings.

.7 Operation and Maintenance Manuals:
.1 Provide detailed hydraulic calculations including summary sheet, and Contractors Material and Test Certificate for aboveground and underground piping and other documentation for incorporation into manual in accordance with NFPA 13.

1.4 QUALITY ASSURANCE

.1 Qualifications:
.1 Installer: company or person specializing in wet sprinkler systems with documented experience approved by manufacturer.
.2 Supply grooved joint couplings, fittings, valves, grooving tools and specialties from a single manufacturer. Use date stamped castings for coupling housings, fittings, valve bodies, for quality assurance and traceability.

1.5 MAINTENANCE MATERIAL SUBMITTALS

.1 Extra Materials:
.1 Provide maintenance materials in accordance with Section 01 78 00.
.2 Provide spare sprinklers and tools in accordance with NFPA 13.

1.6 DELIVERY, STORAGE AND HANDLING

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

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

.3 Storage and Protection:
.1 Store materials indoors in dry location.
.2 Store and protect materials from exposure to harmful weather conditions and at temperature and humidity conditions recommended by manufacturer.

.4 Packaging Waste Management: remove for reuse and return by manufacturer of pallets, crates, padding, and packaging materials in accordance with Section 01 74 20.

PART 2 - PRODUCTS

2.1 DESIGN REQUIREMENTS

.1 Design automatic wet pipe fire suppression sprinkler systems in accordance with required and advisory provisions of NFPA 13, by hydraulic calculations for uniform distribution of water over design area.

.2 Include with each system materials, accessories, and equipment inside and outside building to provide each system complete and ready for use.

.3 Design and provide each system to give full consideration to blind spaces, piping, electrical equipment, ducts, and other construction and equipment in accordance with detailed shop drawings.

.4 Locate sprinkler heads in consistent pattern with ceiling grid, lights, and air supply diffusers.

2.1 DESIGN REQUIREMENTS (Cont'd)

.5 Devices and equipment for fire protection service: ULC approved for use in wet pipe sprinkler systems.

.6 Design systems for earthquake protection for buildings in seismic zones 3 and 4, and only essential and high risk buildings in seismic zone 2.

.7 Location of Sprinkler Heads:
.1 Locate heads in relation to ceiling and spacing of sprinkler heads not to exceed that permitted by NFPA 13 for ordinary hazard occupancy.
.2 Uniformly space sprinklers on branch.

.8 Water Distribution:
.1 Make distribution uniform throughout the area in which sprinkler heads will open.
.2 Discharge from individual heads in hydraulically most remote area to be 100% of specified density.

.9 Density of Application of Water:
.1 Size pipe to provide specified density when system is discharging specified total maximum required flow.

.10 Sprinkler Discharge Area:
.1 Area: hydraulically most remote area as defined in NFPA 13.

.11 Outside Hose Allowances:
.1 Include allowance in hydraulic calculations for outside hose streams.

.12 Friction Losses:
.1 Calculate losses in piping in accordance with Hazen-Williams formula with 'C' value of 120 for steel piping, 150 for copper tubing, and 140 for cement-lined ductile-iron piping.

.13 Design system in accordance with NFPA 13 using following parameters:
.1 All areas shall be designed for hazard coverage indicated with design area & associated densities.
.2 Pipe size and layout:
.1 Hydraulic design.
.2 Sprinkler head layout to NFPA 13 or as directed by authorities having jurisdiction and with sprinkler head centred in at least one (1) direction of ceiling tile.

2.1 DESIGN REQUIREMENTS (Cont'd)

.13 (Cont'd)

.2 Pipe size and layout:(Cont'd)

.3 The hydraulic design shall be sized to accommodate the higher and most remote zones.

.4 Allow for additional sprinkler heads and pipe distribution to suit all existing interferences.

.5 When sidewall sprinklers listed for light hazard occupancies are used, pipe sizing and spacing shall be according to ordinary hazard rules.

.3 Water supply:

.1 Base design on NFPA 13 and obtain water supply for appropriate fire hydrants from municipality. Conduct flow and pressure test of water supply in vicinity of project to verify municipal data and to obtain criteria for bases of design. Adjust water test values to allow for peak period water usage. Hydraulic calculations shall commence at water main connection at source. Provide as part of hydraulic calculation submission, fire hydrant flow test data and deduct 10% as safety factor based on available pressure value.

.4 Zoning:

.1 System zoning as indicated.

.2 Provide supervised isolating valve and flow switch for each zone and as indicated.

.14 Survey the ceiling spaces to determine interferences affecting the sprinkler distribution layout prior to shop drawing submission.

.15 Review architectural, structural, mechanical & electrical drawings to determine interferences affecting the distribution layout prior to shop drawing submission.

.16 Prepare AutoCAD reflected ceilings drawings based on the field surveys and utilizing the Architectural & Engineering Bid documents. Reflected ceiling drawings shall be prepared for

2.1 DESIGN REQUIREMENTS (Cont'd)

.16 (Cont'd)
all buildings with new or revised sprinkler systems.

.17 Reflected ceiling drawings to include identification of ceiling material, floor to ceiling height, ceiling grid, light fixtures, diffusers, fire alarm and public address end devices and any other interferences.

2.2 ABOVE GROUND PIPING SYSTEMS

.1 Provide fittings for changes in direction of piping and for connections.
.1 Make changes in piping sizes through tapered reducing pipe fittings, bushings will not be permitted.
.2 Perform welding in shop; field welding will not be permitted.
.3 Conceal piping in areas with suspended ceiling.

2.3 PIPE, FITTINGS AND VALVES

.1 Pipe:
.1 Ferrous: Schedule 40 and installed in accordance to NFPA 13.
.2 Copper tube: to NFPA 13.

.2 Fittings and joints to NFPA 13:
.1 Ferrous: screwed, welded, flanged or roll grooved.
.1 Grooved joints designed with two ductile iron housing segments, pressure responsive gasket, and zinc-electroplated steel bolts and nuts. Cast with offsetting angle-pattern bolt pads for rigidity and visual pad-to-pad offset contact.
.2 Copper tube: screwed, soldered, brazed, grooved.
.3 Provide welded, threaded, grooved-end type fittings into which sprinkler heads, sprinkler head riser nipples, or drop nipples are threaded.
.4 Plain-end fittings with mechanical couplings and fittings which use steel gripping devices to bite into pipe when pressure is applied will not be permitted.
.5 Rubber gasketted grooved-end pipe and fittings with mechanical couplings are permitted in pipe sizes 32 mm and larger.
.6 Fittings: ULC approved for use in wet pipe sprinkler systems.

2.3 PIPE, FITTINGS AND VALVES (Cont'd)

.2 Fittings and joints to NFPA 13:(Cont'd)
.1 Ferrous:(Cont'd)
.7 Ensure fittings, mechanical couplings, and rubber gaskets are supplied by same manufacturer.
.8 Side outlet tees using rubber gasketted fittings are not permitted.
.9 Sprinkler pipe and fittings: metal.

.3 Valves:
.1 ULC listed for fire protection service.
.2 Gate valves: open by counterclockwise rotation.
.3 Provide rising stem OS & Y wall indicator valve beneath each alarm valve in each riser when more than one alarm valve is supplied from same water supply pipe.
.4 Check valves: flanged clear opening swing or spring actuated check type with flanged inspection and access cover plate for sizes 10 cm and larger.
.5 ULC & FM listed for fire protection service.
.6 Up to NPS 2: bronze, screwed ends, OS&Y rising stem gate valve.
.7 NPS 2-1/2 and over: cast iron, flanged or roll grooved ends, OS&Y rising stem gate or indicating butterfly type.
.8 Check valves: swing type as above.
.9 Ball drip check valve.

.4 Pipe hangers:
.1 ULC listed for fire protection services in accordance with NFPA.

2.4 SPRINKLER HEADS

.1 General: to NFPA 13 and ULC listed for fire services.

.2 Sprinkler Head Type:
.1 Type A: upright brass.
.2 Type B: pendant chrome link and lever type.
.3 Type C: pendant chrome glass bulb type.
.4 Type D: recessed polished satin chrome glass bulb fusible link type with ring and cup.
.5 Type E: flush polished satin chrome link and lever type.
.6 Type F: side wall polished satin chrome link and lever type.

2.4 SPRINKLER HEADS (Cont'd)

.3 Provide nominal 1.2 cm orifice sprinkler heads.
.1 Release element of each head to be of intermediate temperature rating or higher as suitable for specific application.
.2 Provide polished stainless steel ceiling plates or chromium-plated finish on copper alloy ceiling plates, and chromium-plated pendent sprinklers below suspended ceilings.
.3 Provide corrosion-resistant sprinkler heads and sprinkler head guards in accordance with NFPA 13.
.4 Deflector: not more than 75 mm below suspended ceilings.
.5 Ceiling plates: not more than 25 mm deep.
.6 Ceiling cups: not permitted.

2.5 ALARM CHECK VALVE

.1 Alarm check valve to NFPA 13 and ULC listed for fire service.

.2 Provide variable pressure type alarm valve complete with retarding chamber, alarm test valve, alarm shutoff valve, drain valve, pressure gages, accessories, and appurtenances for proper operation of system.

.3 Provide valve complete with internal components that are replaceable without removing the valve from the installed position.

2.6 WATER MOTOR ALARMS

.1 Provide alarms approved weatherproof and guarded type, to sound locally on flow of water in each corresponding sprinkler system.

.2 Mount alarms on outside of outer walls of each building at location as directed.

.3 Provide separate drain piping directly to exterior of building.

2.7 SUPERVISORY SWITCHES

.1 General: to NFPA 13 and ULC listed for fire service.

.2 Valves:
.1 Mechanically attached to valve body, with normally open and normally closed contacts and supervisory capability.

2.7 SUPERVISORY SWITCHES (Cont'd)

.3 Pressure or flow switch type:
.1 With normally open and normally closed contacts and supervisory capability.
.2 Provide switch with circuit opener or closer for automatic transmittal of alarm over facility fire alarm system.
.3 Connect into building fire alarm system.
.4 Connection of switch: Section 28 31 00.
.5 Alarm actuating device: mechanical diaphragm controlled retard device adjustable from 10 to 60 seconds and instantly recycle.

.4 Pressure alarm switch:
.1 With normally open and normally closed contacts and supervisory capability.

2.8 PRESSURE GAUGES

.1 ULC listed and to Section 23 05 19.01.

.2 Maximum limit of not less than twice normal working pressure at point where installed.

2.9 PIPE SLEEVES

.1 Provide pipe sleeves where piping passes through walls, floors, and roofs.

.2 Secure sleeves in position and location during construction.

.3 Provide sleeves of sufficient length to pass through entire thickness ofwalls, floors, and roofs.

.4 Provide 2.5 cm minimum clearance between exterior of piping and interior of sleeve or core-drilled hole.
.1 Firmly pack space with mineral wool insulation.
.2 Seal space at both ends of sleeve or core-drilled hole withplastic waterproof cement which will dry to firm but pliable mass, provide mechanically adjustable segmented elastomeric seal.
.3 In fire walls and fire floors, seal both ends of pipe sleeves or core-drilled holes with ULC listed fill, void, or cavity material.

.5 Sleeves in Masonry and Concrete Walls, Floors, and Roofs:
.1 Provide hot-dip galvanized steel, ductile-iron, cast-iron sleeves.

2.9 PIPE SLEEVES (Cont'd)

.5 (Cont'd)
.2 Core drilling of masonry and concrete may be provided in lieu of pipe sleeves when cavities in core-drilled hole are completely grouted smooth.

.6 Sleeves in Other Than Masonry and Concrete Walls, Floors, and Roofs:
.1 Provide 0.61 mm thick galvanized steel sheet.

2.10 ESCUTCHEON PLATES

.1 Provide one piece split hinge type metal plates for piping passing through walls, floors, and ceilings in exposed spaces.

.2 Provide polished stainless steel plates chromium-plated finish on copper alloy plates in finished spaces.

.3 Provide paint finish on metal plates in unfinished spaces.

2.11 INSPECTOR'S TEST CONNECTION

.1 Locate inspector's test connection at hydraulically most remote part of each system, provide test connections approximately 3 m above floor for each sprinkler system or portion of each sprinkler system equipped with alarm device.

.2 Provide test connection piping to location where discharge will be readily visible and where water may be discharged without property damage.

.3 Provide discharge orifice of same size as corresponding sprinkler orifice.

2.12 SIGNS

.1 Attach properly lettered Bilingual and approved metal signs to each valve and alarm device to NFPA 13.

.2 Permanently fix hydraulic design data nameplates to riser of each system.

2.13 SPARE PARTS CABINET

.1 Provide metal cabinet with extra sprinkler heads and sprinkler head wrench adjacent to each alarm valve. Number and types of extra sprinkler heads as specified in NFPA 13.

PART 3 - EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 INSTALLATION

.1 Install, inspect and test to acceptance in accordance with NFPA 13 and NFPA 25.

3.3 PIPE INSTALLATION

.1 Install piping straight and true to bear evenly on hangers and supports. Do not hang piping from plaster ceilings.

.2 Keep interior and ends of new piping and existing piping thoroughly cleaned of water and foreign matter.

.3 Keep piping systems clean during installation by means of plugs or other approved methods. When work is not in progress, securely close open ends of piping to prevent entry of water and foreign matter.

.4 Inspect piping before placing into position.

3.4 ELECTRICAL CONNECTIONS

.1 Provide electrical work associated with this section under Section 26 05 00.

.2 Provide fire alarm system under Section 28 31 00.

.3 Provide control and fire alarm wiring, including connections to fire alarm systems, in accordance with Canadian Electrical Code.

.4 Provide wiring in rigid metal conduit or intermediate metal conduit.

3.5 DISINFECTION

.1 Disinfect new piping and existing piping.

.2 Fill piping systems with solution containing minimum of 50 parts per million of chlorine and allow solution to stand for minimum of 24 hours.

.3 Flush solution from systems with clean water until maximum residual chlorine content is not greater than 0.2 part per million or residual chlorine content of domestic water supply.

.4 Obtain at least two consecutive satisfactory bacteriological samples from piping, analyzed by certified laboratory, and submit results prior to piping being placed into service.

3.6 CONNECTIONS TO EXISTING WATER SUPPLY SYSTEMS

.1 Notify Department Representative in writing at least 15 days prior to connection date.

.2 Use tapping or drilling machine valve and mechanical joint type sleeves for connections to be made under pressure.

.3 Bolt sleeves around main piping.

.4 Bolt valve to branch connection. Open valve, attach drilling machine, make tap, close valve, and remove drilling machine, without interruption of service.

.5 Furnish materials required to make connections into existing water supply systems, and perform excavating, backfilling, and other incidental labour as required.

3.7 FIELD PAINTING

.1 Clean, pretreat, prime, and paint new systems including valves, piping, conduit, hangers, supports, miscellaneous metalwork, and accessories.

.2 Apply coatings to clean, dry surfaces, using clean brushes.

.3 Clean surfaces to remove dust, dirt, rust, and loose mill scale.

.4 Immediately after cleaning, provide metal surfaces with 1 coat of pretreatment primer applied to minimum dry film thickness of 0.3 ml,

3.7 FIELD PAINTING (Cont'd)

.4 (Cont'd)
and one coat of zinc chromate primer applied to minimum dry film thickness of 1.0 ml.

.5 Shield sprinkler heads with protective covering while painting is in progress.

.6 Upon completion of painting, remove protective covering from sprinkler heads.

.7 Remove sprinkler heads which have been painted and replace with new sprinkler heads.

.8 Provide primed surfaces with following:
- .1 Piping in Finished Areas:
  - .1 Provide primed surfaces with 2 coats of paint to match adjacent surfaces.
  - .2 Provide valves and operating accessories with 1 coat of red alkyd gloss enamel applied to minimum dry film thickness of 1.0 mil.
  - .3 Provide piping with 50 mm wide red enamel bands self-adhering red plastic bands spaced at maximum of 6 m intervals throughout piping systems.
- .2 Piping in Unfinished Areas:
  - .1 Provide primed surfaces with one coat of red alkyd gloss enamel applied to minimum dry film thickness of 1.0 mil in attic spaces, spaces above suspended ceilings, crawl spaces, pipe chases, mechanical equipment room, and spaces where walls or ceiling are not painted or not constructed of a prefinished material.
  - .2 Provide piping with 50 mm wide red enamel bands self-adhering red plastic bands spaced at maximum of 6 m intervals.

3.8 FIELD QUALITY CONTROL

.1 Site Test, Inspection:

.1 Perform test to determine compliance with specified requirements in presence of Departmental Representative.

.2 Test, inspect, and approve piping before covering or concealing.

.3 Preliminary Tests:

.1 Hydrostatically test each system at 1378 kPa for a 2 hour period with no leakage or reduction in pressure.

.2 Flush piping with potable water in accordance with NFPA 13.

.3 Piping above suspended ceilings: tested, inspected, and approved before installation of ceilings.

.4 Test alarms and other devices.

.5 Test water flow alarms by flowing water through inspector's test connection. When tests have been completed and corrections made, submit signed and dated certificate in accordance with NFPA 13.

.4 Formal Tests and Inspections:

.1 Do not submit request for formal test and inspection until preliminary test and corrections are completed and approved.

.2 Submit written request for formal inspection at least 15 days prior to inspection date.

.3 Repeat required tests as directed.

.4 Correct defects and make additional tests until systems comply with contract requirements.

.5 Furnish appliances, equipment, instruments, connecting devices, and personnel for tests.

.6 Authority of Jurisdiction, will witness formal tests and approve systems before they are accepted.

.2 Manufacturer's Field Services:

.1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Field Reports as described in PART 1 - ACTION AND INFORMATIONAL SUBMITTALS.

.2 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.

.3 Schedule site visits, to review Work, as directed in PART 1 - QUALITY ASSURANCE.

3.8 FIELD QUALITY CONTROL (Cont'd)

.3 Site Tests:.

.1 Testing to be witnessed by authority having jurisdiction.

.2 Develop, with Departmental Representative assistance, detailed instructions for O & M of this installation.

3.9 CLEANING

.1 Clean in accordance with Section 01 74 11.

.1 Remove surplus materials, excess materials, rubbish, tools and equipment.

3.10 APPENDICES

.1 The following is hydraulic calculations for existing system. Contractor can use this as basis for design of new system.

.2 Carry out water flow test to confirm available water pressure.

3.10 APPENDICES

DISANO SPRINKLER DESIGN
BCIN NO. 30002

LAURIN
General Contractor • Entrepreneur Général
Reviewed
Reviewed as noted
Revise and Resubmit as Noted
Date 20 July 2011
This review does not relieve the subcontractor of responsibility to comply with contract documents

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HYDRAULIC CALCULATIONS

AREA ___ #1 ____ Sheet No. __ 1 OF 6 _

PROJECT R.032062.001
REF: SPEC. 21 00 00

Date _06/15/2011_

CANADA CENTRE FOR INLAND WATERS
867 LAKESHORE ROAD
BURLINGTON, ONTARIO

Drawing No. ____ 11-9350 SP1 ___
Authority __ FIRE DEPARTMENT
Occupancy __ ORDINARY HAZARD GROUP I
__ PLUS 1 LEVEL OF IN-RACKS AS PER SPECS

DESIGN

Density	_0.15 GPM PER SQ.FT.
Area	_1500 SQ.FT PLUS 1 LEVEL OF IN-RACKS
Coverage per sprinkler	_11.42 X 10.0 PLUS IN-RACKS MAX. SPACING 8'-0"
Sprinklers in design area	_14 A.S AT ROOF PLUS 4 A.S. FOR IN-RACK

WATER DEMAND

Sprinklers	_ 340.61 GPM @ 49.99 PSI
Inside Hose Allowance	_ 100 GPM FOR HOSES
Outside (Hydrant) Allowance	_ 150 GPM FOR HYDRANTS
Total	_ 590.61 GPM @ 57.84 PSI

HYDRAULIC DATA

K for Sprinklers	__ 5.6 ____
C for Piping	100 110 120
C for Underground	100 120 140 150

LICENSED PROFESSIONAL ENGINEER
R.A.SEVERINI
BCIN 21257
06/16/11
PROVINCE OF ONTARIO

APPENDICES Cont'd

Canada Centre For Inland Waters 867 Lakeshore Road Burlington, Ontario D-A #1

PAGE 1

HYDRAULIC CALCULATIONS AT SPECIFIED FLOW

THE FOLLOWING SPRINKLERS ARE OPERATING IN:

[ ] TEST AREA 1 [ ] TEST AREA 2 [ ] TEST AREA 3 [ ] REMOTE AREA

Elevation of sprinklers = Elevation above water test.

REF. PT.	K	ELEV. ft	FLOW gpm	PRESSURE psi
101	5.60	35.00	18.32	10.70
102	5.60	35.00	17.97	10.30
103	5.60	35.00	17.89	10.20
104	5.60	35.00	19.13	11.67
105	5.60	35.00	17.63	9.91
106	5.60	35.00	17.29	9.53
107	5.60	35.00	17.22	9.45
108	5.60	35.00	18.11	10.46
109	5.60	35.00	18.02	10.35
110	5.60	35.00	17.56	9.84
111	5.60	35.00	17.24	9.48
112	5.60	35.00	17.15	9.38
113	5.60	35.00	18.03	10.37
114	5.60	35.00	17.96	10.28
201	5.60	9.00	23.46	17.54
202	5.60	9.00	22.80	16.57
203	5.60	9.00	22.47	16.09
204	5.60	9.00	22.37	15.95

THE SPRINKLER SYSTEM FLOW IS 340.61 gpm

THE OUTSIDE HOSE FLOW AT REFERENCE POINT N0. 1 IS 0.00 gpm

[ ] THE INSIDE HOSE [ ] RACK SPKLR'S.

[ ] YARD HYDT. FLOW IS 250.00 gpm

THE FOLLOWING PRESSURES & FLOWS OCCUR

---> AT REF. PT. 1 <---

STATIC PRESSURE	80.00 psi		
RESIDUAL PRESSURE	75.00 psi	AT	738.00 gpm
TOTAL SYSTEM FLOW	590.61 gpm		
AVAILABLE PRESSURE	76.69 psi	AT	590.61 gpm
OPERATING PRESSURE	57.84 psi	AT	590.61 gpm
PRESSURE REMAINING	18.85 psi		

THE ABOVE RESULTS INCLUDE 6.00 psi FRICTION LOSS AT REF. PT. # 3 FOR A

[ ] BACKFLOW PREVENTER [ ] METER

[ ] DETECTOR CHECK VALVE [ ] OTHER DEVICE

APPENDICES Cont'd

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PAGE 2

FITTING Equivalent Length per NFPA 13 2002,14.4.3
'-' Indicates Equivalent Length. 'T' Indicates Threaded Fitting
1=45 Elbow, 2=90 Elbow, 3='T'/Cross, 4=Butterfly Valve, 5=Gate Valve, 6=Swing Check Valve

FROM	TO	FLOW (gpm)	PIPE (ft)	FITS	EQV. (ft)	H-W C	PIPE TYPE	DIA. (in)	FRIC. (psi)	ELEV. (psi)	FROM (psi)	TO (psi)	DIFF (psi)
1	2	440.61	253.00	362	123.73	140	101	7.980	0.002	0.000	57.84	57.26	0.58
2	3	440.61	120.00	2	13.00	120	1	7.981	0.002	0.000	57.26	56.99	0.27
3	4	440.61	2.00	3	21.12	120	2	4.260	0.043	0.000	56.99	49.99	7.00
4	5	340.61	34.00	346	66.00	120	2	4.260	0.027	14.733	49.99	32.57	2.69
5	6	340.61	334.00	22222	44.90	120	2	4.260	0.027	0.000	32.57	22.39	10.18
6	7	340.61	31.00	2342	44.22	120	2	3.260	0.099	0.000	22.39	14.95	7.44
7	8	249.52	8.00	3	17.42	120	2	3.260	0.056	0.000	14.95	13.54	1.41
8	9	176.21	11.42	0	0.00	120	2	3.260	0.029	0.000	13.54	13.20	0.34
9	10	87.95	11.42	0	0.00	120	2	3.260	0.008	0.000	13.20	13.11	0.09
8	11	73.31	1.00	3	7.94	120	2	1.682	0.144	0.433	13.54	11.81	1.29
9	12	88.26	1.00	3	7.94	120	2	1.682	0.204	0.433	13.20	10.95	1.82
10	13	87.95	1.00	3	7.94	120	2	1.682	0.202	0.433	13.11	10.87	1.81
11	101	54.18	5.58	3	7.94	120	2	1.682	0.082	0.000	11.81	10.70	1.11
101	102	35.86	10.00	0	0.00	120	2	1.682	0.038	0.000	10.70	10.30	0.40
102	103	17.89	10.00	0	0.00	120	2	1.682	0.011	0.000	10.30	10.20	0.10
11	104	19.13	4.58	3	7.94	120	2	1.682	0.012	0.000	11.81	11.67	0.15
12	105	52.14	5.58	3	7.94	120	2	1.682	0.077	0.000	10.95	9.91	1.04
105	106	34.51	10.00	0	0.00	120	2	1.682	0.036	0.000	9.91	9.53	0.37
106	107	17.22	10.00	0	0.00	120	2	1.682	0.010	0.000	9.53	9.45	0.08
12	108	36.13	4.42	3	7.94	120	2	1.682	0.039	0.000	10.95	10.46	0.49
108	109	18.02	10.00	0	0.00	120	2	1.682	0.011	0.000	10.46	10.35	0.11
13	110	51.96	5.58	3	7.94	120	2	1.682	0.076	0.000	10.87	9.84	1.03
110	111	34.39	10.00	0	0.00	120	2	1.682	0.036	0.000	9.84	9.48	0.36
111	112	17.15	10.00	0	0.00	120	2	1.682	0.010	0.000	9.48	9.38	0.10
13	113	35.99	4.42	3	7.94	120	2	1.682	0.039	0.000	10.87	10.37	0.50
113	114	17.96	10.00	0	0.00	120	2	1.682	0.011	0.000	10.37	10.28	0.09
7	14	91.09	32.00	3	17.42	120	2	3.260	0.009	0.000	14.95	14.52	0.43
14	15	91.09	40.00	32	14.76	120	2	2.157	0.064	0.000	14.52	11.00	3.52
15	16	91.09	25.00	0	0.00	120	2	2.157	0.064	-10.833	11.00	20.23	1.61
16	201	91.09	6.00	22	6.44	120	2	1.682	0.216	0.000	20.23	17.54	2.68
201	202	67.63	8.00	0	0.00	120	2	1.682	0.124	0.000	17.54	16.57	0.97
202	203	44.84	8.00	0	0.00	120	2	1.682	0.058	0.000	16.57	16.09	0.48
203	204	22.37	8.00	0	0.00	120	2	1.682	0.016	0.000	16.09	15.95	0.14

A MAX. VELOCITY OF 13.15 ft./sec. OCCURS BETWEEN REF. PT. 16 AND 201

Sprinkler-CALC Release 7.2 Win
By Walsh Engineering Inc.
North Kingstown R.I. U.S.A.

APPENDICES Cont'd

H Y D R A U L I C C A L C U L A T I O N S

C O V E R S H E E T

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W A T E R S U P P L Y

STATIC PRESSURE	(psi)	80
RESIDUAL PRESSURE	(psi)	75
RESIDUAL FLOW	(gpm)	738

B O O S T E R P U M P S

NUMBER OF BOOSTER PUMPS 0

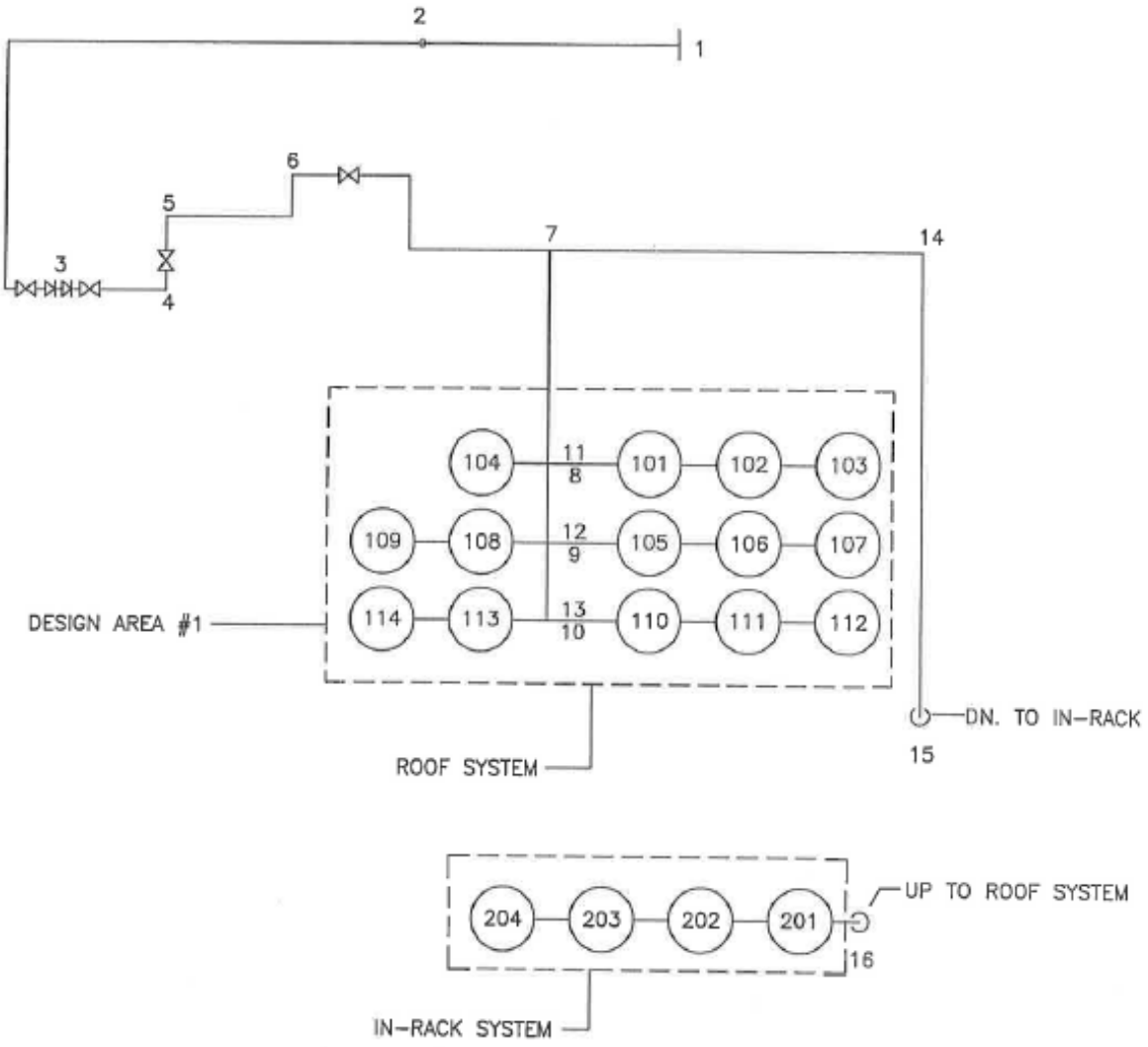
S P R I N K L E R S

MINIMUM FLOW PER SPRINKLER	(gpm)	17.15
MINIMUM PRESSURE PER SPRINKLER	(psi)	9.38

THIS SYSTEM OPERATES AT A FLOW OF 340.61 gpm AT A PRESSURE OF 49.99 psi
AT THE BASE OF THE RISER (REF. PT. 4)

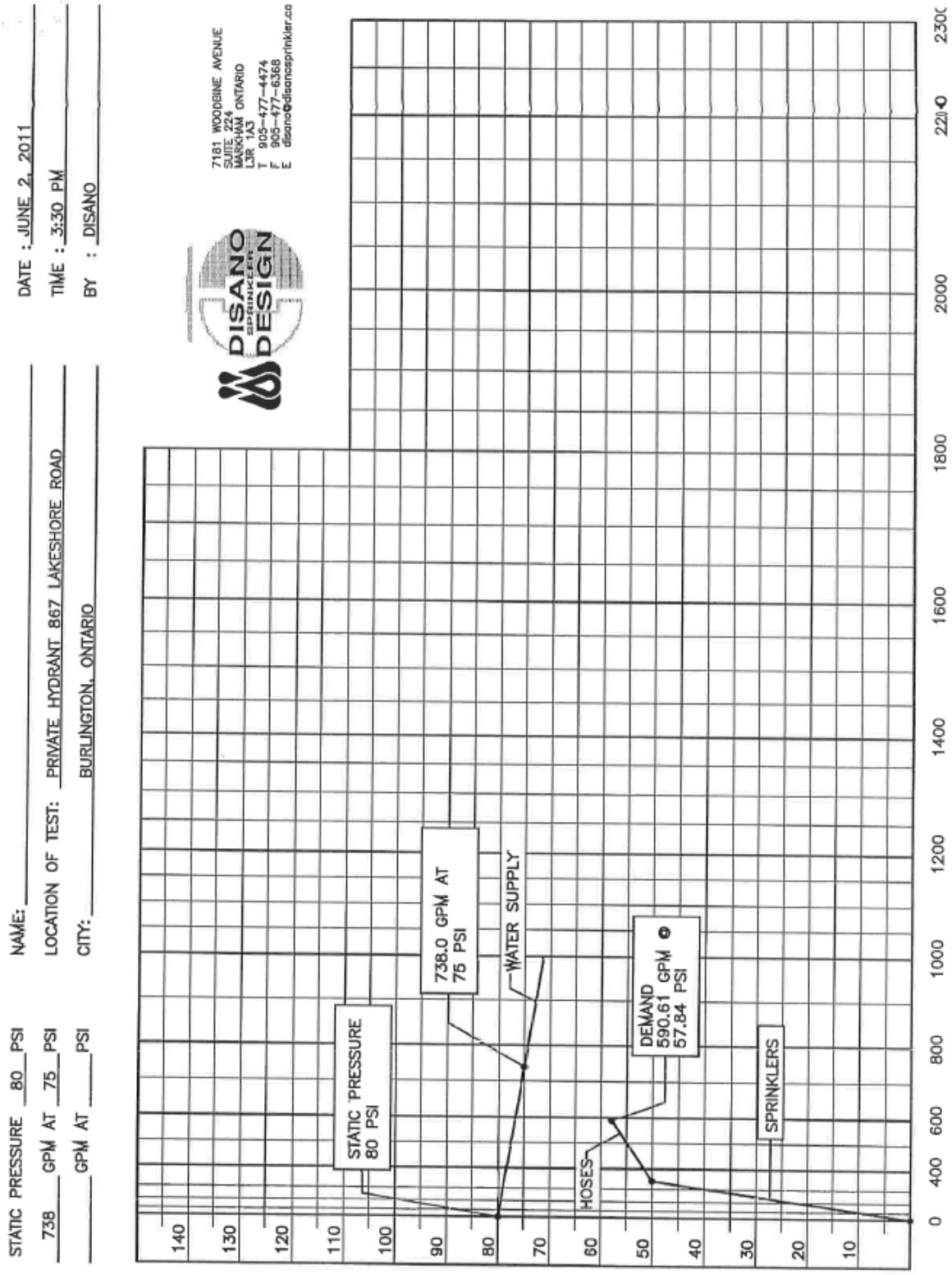
PIPES USED FOR THIS SYSTEM
==========
101 CAST IRON CEMENT LINED (150)
001 SCHEDULE 40
002 SCHEDULE 10

APPENDICES Cont'd



I.D. POINTS SCHEMATIC FOR HYDRAULIC CALCULATION

APPENDICES Cont'd



END

PART 1 - GENERAL

1.1 REFERENCES

.1 National Fire Protection Association (NFPA)
.1 NFPA 13-2013, Standard for the Installation of Sprinkler Systems.
.2 NFPA 25-2008, Water-Based Fire Protection Systems Handbook.

.2 Underwriter's Laboratories of Canada (ULC)
.1 CAN/ULC-S543-09, Standard for Internal Lug Quick Connect Coupling for Fire Hose.
.2 CAN/ULC-S543-09-AM1, Amendment 1 to Standard for Internal Lug Quick Connect Coupling for Fire Hose.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00.

.2 Product Data:
.1 Provide manufacturer's printed product literature and data sheets for equipment and systems, applicable series designation or style and include product characteristics, performance criteria, physical size, finish and limitations.

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

.4 Samples:
.1 Submit samples of following:
.1 Each type of sprinkler head.
.2 Signs and valve tags.

.5 Test reports:
.1 Submit certified test reports for packaged fire pumps from approved independent testing laboratories, indicating compliance with specifications for specified performance characteristics and physical properties.
.2 Test hydrostatically to meet requirements of fire protection system to which it will be connected.

.6 Certificates:
.1 Submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

1.2 ACTION AND INFORMATIONAL SUBMITTALS (Cont'd)

.6 Certificates:(Cont'd)
.2 Submit drawings stamped and signed by professional engineer registered or licensed in Province of Ontario, Canada confirming constructional testing in conformance with NFPA 13 and these specifications.

.7 Manufacturers' Instructions:
.1 Instructions: provide manufacturer's installation instructions.

.8 Field Quality Control Submittals:
.1 Manufacturer's Field Reports: submit manufacturer's field reports specified.

1.3 CLOSEOUT SUBMITTALS

.1 Provide maintenance data for incorporation into manual specified in Section 01 78 00.

.2 Provide detailed hydraulic calculations including: summary sheet, Contractor's Material and Test Certificate for aboveground and underground piping, as well as other deliverables for incorporation into manual specified in Section 01 78 00, in accordance with NFPA 13.

.3 Submit certificate signed and sealed by a Professional Engineer confirming registered or licenced design and installation of sprinkler system (wet and dry) is in accordance with NBC and NFPA 13.

1.4 QUALITY ASSURANCE

.1 Qualifications:
.1 Installer: company or person specializing in dry sprinkler systems with documented experience approved by manufacturer.
.2 Supply grooved joint couplings, fittings, valves, grooving tools and specialties from a single manufacturer. Use date stamped castings for coupling housings, fittings, valve bodies, for quality assurance and traceability.

1.5 MAINTENANCE MATERIAL SUBMITTALS

.1 Extra Materials:
.1 Provide maintenance materials in accordance with Section 01 78 00.
.2 Provide spare sprinklers and tools in accordance with NFPA 13.

1.6 DELIVERY, STORAGE AND HANDLING

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

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

PART 2 - PRODUCTS

2.1 ENGINEERING DESIGN CRITERIA

.1 Design system in accordance with NFPA 13, using following parameters:
.1 All areas shall be designed for hazard coverage indicated with design area & associated densities.
.2 Pipe size and layout:
.1 Hydraulic design.
.2 Sprinkler head layout to NFPA 13 or as directed by authorities having jurisdiction and with sprinkler head centred in at least one (1) direction of ceiling tile.
.3 The hydraulic design shall be sized to accommodate the higher and most remote zones.
.4 Allow for additional sprinkler heads and pipe distribution to suit all existing interferences.
.5 When sidewall sprinklers listed for light hazard occupancies are used, pipe sizing and spacing shall be according to ordinary hazard rules.
.3 Water supply:
.1 Base design on NFPA 13 and obtain water supply for appropriate fire hydrants from municipality. Conduct flow and pressure test of water supply in vicinity of project to verify municipal data and to obtain criteria for bases of design. Adjust water test values to allow for peak period water usage. Hydraulic calculations shall commence at water main connection at source. Provide as part of hydraulic calculation submission, fire hydrant flow test data and deduct 10% as safety factor based on available pressure value.

2.1 ENGINEERING DESIGN CRITERIA (Cont'd)

.1 (Cont'd)
.4 Zoning:
.1 System zoning as indicated.
.2 Provide supervised isolating valve and flow switch for each zone and as indicated.

2.2 REFLECTED CEILINGS AND SITE SURVEYS

.1 Survey the ceiling spaces to determine interferences affecting the sprinkler distribution layout prior to shop drawing submission.

.2 Review architectural, structural, mechanical & electrical drawings to determine interferences affecting the distribution layout prior to shop drawing submission.

.3 Prepare AutoCAD reflected ceilings drawings based on the field surveys and utilizing the Architectural & Engineering Tender documents. Reflected ceiling drawings shall be prepared for all buildings with new or revised sprinkler systems.

.4 Reflected ceiling drawings to include identification of ceiling material, floor to ceiling height, ceiling grid, light fixtures, diffusers, fire alarm and public address end devices and any other interferences.

2.3 PIPE, FITTINGS AND VALVES

.1 Pipe:
.1 Ferrous: Schedule 40 and installed in accordance to NFPA 13.
.2 Copper tube: to NFPA 13.

.2 Fittings and joints to NFPA 13:
.1 Ferrous: screwed, welded, flanged or roll grooved.
.1 Grooved joints designed with two ductile iron housing segments, flush seal gasket for dry service, and zinc-electroplated steel bolts and nuts. Cast with offsetting angle-pattern bolt pads for rigidity and visual pad-to-pad offset contact.
.2 Copper tube: screwed, soldered, brazed, grooved.
.3 Auxiliary valves:
.1 ULC listed for fire protection service.

2.3 PIPE, FITTINGS AND VALVES (Cont'd)

.2 Fittings and joints to NFPA 13:(Cont'd)
.1 Ferrous:(Cont'd)
.3 Auxiliary valves:(Cont'd)
.2 Up to NPS 2: bronze, screwed ends, grooved, OS & Y gate.
.3 NPS 2 1/2 and over: cast or ductile iron, flanged or roll grooved ends, indicating butterfly valve.
.4 Swing or spring-actuated check valves.
.5 Ball drip.
.6 Tamper devices wired back to fire alarm panel.
.4 Pipe hangers:
.1 ULC listed for fire protection services.

2.4 SPRINKLER HEADS

.1 General: to NFPA 13 and ULC listed for fire services.

2.5 SPRINKLER HEAD TYPE A

.1 Upright brass.

2.6 SPRINKLER HEAD TYPE B

.1 Pendant chrome link and lever type.

2.7 SPRINKLER HEAD TYPE C

.1 Pendant chrome glass bulb type.

2.8 SPRINKLER HEAD TYPE D

.1 Recessed polished satin chrome glass bulbfusible link type with ring and cup.

2.9 SPRINKLER HEAD TYPE E

.1 Flush polished satin chrome link and lever type.

2.10 SPRINKLER HEAD TYPE F

.1 Side wall polished satin chrome link and lever type.

2.11 AUXILIARY SUPERVISORY SWITCHES

.1 General: to NFPA 13 and ULC listed for fire service.

.2 Valves:
.1 Mechanically attached to valve body, with normally open and normally closed contacts and supervisory capability.

.3 Flow switch type:
.1 With normally open and normally closed contacts and supervisory capability.

.4 Pressure alarm switch:
.1 With normally open and normally closed contacts and supervisory capability.

2.12 DRY PIPE VALVE

.1 ULC listed.

.2 Cast or ductile iron, flanged or grooved end type, sized to suit water main.

.3 Components:
.1 Accelerator.
.2 Air maintenance device with low pressure alarm.
.3 Alarm pressure switch with supervisory capability.
.4 Pressure gauges.
.5 Drain valve.
.6 Test valve with associated piping.
.7 Shut off valve - OS & Y with tamper-proof device wired back to fire alarm panel.
.8 Required air pressure 90 kPa (13 psi).

.4 Provide valve complete with internal components that are replaceable without removing valve from installed position.

2.13 SINGLE INTERLOCK - PREACTION EQUIPMENT

.1 General
.1 Single interlock preaction systems are required as indicated on the drawings.
.2 System shall utilize electric/pneumatic actuation system pressure. The system shall only trip upon two separate and distinct events as follows:
.1 An electric detector must go into alarm condition within the coverage area.
.2 System must lose air pressure due to the fusing of a sprinkler head.

2.13 SINGLE INTERLOCK - PREACTION EQUIPMENT (Cont'd)

.1 (Cont'd)

.2 (Cont'd)

.3 The valve shall not trip upon only one of these events occurring. The system piping shall be continuously supervised for "low air" conditions. The valve trim shall include a low air pressure switch in conjunction with an electric solenoid valve to create the double interlock function. The release control panel shall hve a cross zoned releasing circuit to ensure that both the low air signal and an electric detector signal are received before the panel will send a release signal to open the electric solenoid valve. The air pressure maintained in the piping system shall be a minimum of 48 kPa.

.2 Preaction Valve

.1 Ductile iron body conforming to ASTM A-536 complete with aluminum bronze, low differential clapper with positive latching device.

.2 Valve to be UL listed and FM approved for use in the above mentioned system. The valve shall be operable by both automatic and manual means.

.3 Valve shall be of the straight pattern deluge type with a shotgun check valve mounted above. Valve shall have anti-reseating clapper. The valve shall have an external reset mechanism capable of resetting without opening the valve and shall be rated for working pressures of 1206 kPa.

.3 Check Valve

.1 The check valve shall be UL listed and FM approved for use in a double interlock preaction system in conjunction with the preaction valve.

.4 Trim

.1 Provide all necessary trim for a single interlocked, electric/pneumatic with cross zoned panel system configuration. The trim shall be UL listed and FM Approved for use with the preaction valve assembly and shall include but not be limited to the following components:

.1 Alarm and Alarm Test Valves
.2 Water Supply Pressure Gauge
.3 Diaphragm Chamber Pressure Gauge
.4 System Air Pressure Gauge
.5 Manual Emergency Pull Station

2.13 SINGLE INTERLOCK - PREACTION EQUIPMENT (Cont'd)

.4 (Cont'd)

.1 (Cont'd)

.6 Electric Solenoid Valve 24 vDC, normally closed type.

.7 Pressure Alarm Switch

.8 Supervisory Air Pressure Switch.

.5 Air Maintenance Device

.1 The device shall be UL listed and FM Approved. The air maintenance device shall include a strainer, restriction orifice, check valve, adjustable air regulator and appropriate shut off valves. It shall be rated for a minimum inlet pressure of 1206 kPai.

.6 Compressor

.1 The compressor shall be integrally mounted on an ASME rated air receiver tank. The unit shall include the compressor, motor, v-belt drive, enclosed belt guard, pressure switch for automatic start/stop operation, unloader check valve, pressure gauge and ASME safety relief valve. The units shall be capable of filling the system piping with the required system air pressure within 30-minutes.

.2 Compressor and tank shall be mounted on type P-3 isolators.

.3 The compressor shall be rated for 208 V/3ph service.

.7 Release Control Panel

.1 The control panel shall be UL listed and FM Approved. It shall conform to the requirements of NFPA 72 and NFPA 13. The panel shall include batteries for required emergency power back up power. The panel shall have a test mode that will automatically disable all releasing circuits. The panel shall be capable of automatically resetting the initiating and indicating circuits after detecting each alarm condition initiated by a test. The test mode shall be capable of automatically terminating after a prolonged period of inactivity.

.8 Detectors

.1 The detectors shall be smoke detectors in accordance with Electrical Division specifications - Single Interlock - Pre-Action - Alarm Valve.

2.14 COMPRESSED AIR SUPPLY

.1 Automatic Air Compressor.

.2 ULC listed.

.3 Capacity:
.1 To restore normal air pressure in system within 30 minutes.
.2 To provide air pressure of 140 kPa in excess of calculated trip pressure of dry pipe valve in accordance with instruction sheet furnished with dry pipe valve.

.4 Piping: ferrous, NPS 3/4 screwed joints and fittings, to NFPA 13.

.5 Compressor shall be supplied in acoustic housing to limit sound.

.6 Compressor shall be with 100 litre storage tank, 208V/3PH/0.5 HP.

2.15 PRESSURE GAUGES

.1 ULC listed and to Section 23 05 19.01.

.2 Maximum limit of not less than twice normal working pressure at point where installed.

2.16 RELIEF VALVE

.1 ULC listed.

2.17 SPARE PARTS CABINET

.1 For storage of maintenance materials, spare sprinkler heads and special tools.

.2 Construct to sprinkler head manufacturers standard.

PART 3 - EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 INSTALLATION

.1 Install, inspect and test to acceptance in accordance with NFPA 13.

.2 Testing to be witnessed by Fire Commissioner of authority having jurisdiction.

.3 Install spare parts cabinet.

.4 Pressure gauges:
- .1 Location:
  - .1 On water side and air side of dry pipe valve.
  - .2 At air receiver.
  - .3 In each independent pipe from air supply to dry pipe valve.
  - .4 At exhausters and accelerators.
- .2 Install to permit removal.
- .3 Locate so as not subjected to freezing.

.5 Valve identification:
- .1 Identify drain valve, by-pass valves and main shut-off valve and all auxiliary valves.

3.3 FIELD QUALITY CONTROL

.1 Manufacturer's Field Services:
- .1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Field Reports as described in PART 1 - ACTION AND INFORMATIONAL SUBMITTALS.
- .2 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.
- .3 Schedule site visits, to review Work, as directed in PART 1 - QUALITY ASSURANCE.

3.4 CLEANING

.1 Clean in accordance with Section 01 74 11.

.1 Remove surplus materials, excess materials, rubbish, tools and equipment.

END

PART 1 - GENERAL

1.1 REFERENCES

.1 American National Standards Institute (ANSI)/American Society of Mechanical Engineers International (ASME)
.1 ANSI/ASME B16.15-2011, Cast Copper Alloy Threaded Fittings: Classes 125 and 250.
.2 ANSI B16.18-01(R2005), Cast Copper Alloy Solder Joint Pressure Fittings.
.3 ANSI/ASME B16.22-01(R2005), Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.

.2 ASTM International Inc. (ASTM)
.1 ASTM A307-10, Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
.2 ASTM B88M-05(2011), Standard Specification for Seamless Copper Water Tube (Metric).

.3 American Water Works Association (AWWA)
.1 ANSI/AWWA C111/A21.11-12, Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.

.4 Canadian Standards Association (CSA International)
.1 CSA B242-05(R2011), Groove and Shoulder Type Mechanical Pipe Couplings.

.5 Department of Justice Canada (Jus)
.1 Canadian Environmental Protection Act, 1999, c. 33 (CEPA).

.6 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
.1 Material Safety Data Sheets (MSDS).

.7 Manufacturer's Standardization Society of the Valve and Fittings Industry (MSS).
.1 MSS-SP-67-2002a, Butterfly Valves.
.2 MSS-SP-70-2006, Gray Iron Gate Valves, Flanged and Threaded Ends.
.3 MSS-SP-71-2005, Gray Iron Swing Check Valves, Flanged and Threaded Ends.
.4 MSS-SP-80-2008, Bronze Gate, Globe, Angle and Check Valves.

.8 National Research Council (NRC)/Institute for Research in Construction
.1 NRCC 47668, National Plumbing Code of Canada (NPC) - 2010.

1.1 REFERENCES (Cont'd)

.9 Transport Canada (TC)
.1 Transportation of Dangerous Goods Act, 1992, c. 34 (TDGA).

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00.

.2 Product Data:
.1 Provide manufacturer's printed product literature and datasheets for insulation and adhesives, and include product characteristics, performance criteria, physical size, finish and limitations.

1.3 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle in accordance with Section 01 33 00.

PART 2 - PRODUCTS

2.1 PIPING

.1 Domestic hot, cold and recirculation systems, within building.
.1 Above ground: copper tube, hard drawn, type L: to ASTM B88M.
.2 Buried or embedded: copper tube, soft annealed, type K: to ASTM B88M, in long lengths and with no buried joints.

2.2 FITTINGS

.1 Cast bronze threaded fittings, Class 125: to ANSI/ASME B16.15.

.2 Cast copper, solder type: to ANSI/ASME B16.18.

.3 Wrought copper and copper alloy, solder type: to ANSI/ASME B16.22.

2.3 JOINTS

.1 Rubber gaskets, latex-free 1.6 mm thick: to ANSI/AWWA C111/A21.11.

.2 Bolts, nuts, hex head and washers: to ASTM A307, heavy series.

.3 Solder: 95/5 tin copper alloy.

2.3 JOINTS (Cont'd)

.4 Teflon tape: for threaded joints.

.5 Grooved couplings: designed with angle bolt pads to provide rigid joint, complete with EPDM flush seal gasket.

.6 Dielectric connections between dissimilar metals: dielectric fitting, complete with thermoplastic liner.

2.4 BALL VALVES

.1 NPS 2 and under, screwed:
.1 Class 150.
.2 Bronze body, as specified Section 23 05 23.01.

.2 NPS 2 and under, soldered:
.1 To ANSI/ASME B16.18, Class 150.
.2 Bronze body, chrome plated brass stainless steel ball, PTFE adjustable packing, brass gland and PTFE Bunan seat, steel lever handle, with NPT to copper adaptors as specified Section 23 05 23.01.

PART 3 - EXECUTION

3.1 APPLICATION

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

3.2 INSTALLATION

.1 Install in accordance with NPC, and local authority having jurisdiction.

.2 Assemble piping using fittings manufactured to ANSI standards.

.3 Install CWS piping below and away from HWS and HWC and other hot piping so as to maintain temperature of cold water as low as possible.

.4 Connect to fixtures and equipment in accordance with manufacturer's written instructions unless otherwise indicated.

3.2 INSTALLATION (Cont'd)

.5 Buried tubing:
.1 Lay in well compacted washed sand in accordance with AWWA Class B bedding.
.2 Bend tubing without crimping or constriction. Minimize use of fittings.

3.3 VALVES

.1 Isolate equipment, fixtures and branches with ball valves.

3.4 PRESSURE TESTS

.1 Test pressure: greater of 1 times maximum system operating pressure or 860 kPa.

3.5 DISINFECTION

.1 Flush out, disinfect and rinse system to requirements of authority having jurisdiction and approval of Departmental Representative.

END

PART 1 - GENERAL

1.1 REFERENCES

.1 ASTM International Inc.
.1 ASTM B32-08, Standard Specification for Solder Metal.
.2 ASTM B306-09, Standard Specification for Copper Drainage Tube (DWV).
.3 ASTM C564-11, Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings.

.2 Canadian Standards Association (CSA International).
.1 CSA B67-1972(R1996), Lead Service Pipe, Waste Pipe, Traps, Bends and Accessories.
.2 CSA B70-12, Cast Iron Soil Pipe, Fittings and Means of Joining.
.3 CAN/CSA-B125.3-11, Plumbing Fittings.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00.

1.3 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle in accordance with Section 01 61 00.

.2 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.

PART 2 - PRODUCTS

2.1 COPPER TUBE AND FITTINGS

.1 Above ground sanitary storm and vent Type DWV to: ASTM B306.
.1 Fittings.
.1 Cast brass: to CAN/CSA-B125.3.
.2 Wrought copper: to CAN/CSA-B125.3.
.2 Solder: tin-lead, 50:50, type 50A.

2.2 CAST IRON PIPING AND FITTINGS

.1 Buried sanitary storm and vent minimum NPS 3, to: CSA B70, with one layer of protective coating of.
- .1 Joints:
  - .1 Mechanical joints:
    - .1 Neoprene or butyl rubber compression gaskets: to CSA B70. ASTM C564 or
    - .2 Stainless steel clamps.
  - .2 Hub and spigot:
    - .1 Caulking lead: to CSA B67.
    - .2 Cold caulking compounds.
- .2 Above ground sanitary storm and vent: to CSA B70.
  - .1 Joints:
    - .1 Hub and spigot:
      - .1 Caulking lead: to CSA B67.
    - .2 Mechanical joints:
      - .1 Neoprene or butyl rubber compression gaskets with stainless steel clamps.

PART 3 - EXECUTION

3.1 APPLICATION

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

3.2 INSTALLATION

.1 Install in accordance with National Plumbing Code, Provincial Plumbing Code and local authority having jurisdiction.

3.3 TESTING

.1 Pressure test buried systems before backfilling.

.2 Hydraulically test to verify grades and freedom from obstructions.

3.4 PERFORMANCE VERIFICATION

.1 Cleanouts:
- .1 Ensure accessible and that access doors are correctly located.
- .2 Open, cover with linseed oil and re-seal.

3.4 PERFORMANCE VERIFICATION (Cont'd)

.1 Cleanouts:(Cont'd)

.3 Verify that cleanout rods can probe as far as the next cleanout, at least.

.2 Test to ensure traps are fully and permanently primed.

.3 Ensure that fixtures are properly anchored, connected to system and effectively vented.

.4 Affix applicable label (sanitary, vent, etc.) c/w directional arrows every floor or 4.5 m (whichever is less).

END

PART 1 - GENERAL

1.1 SUMMARY

.1 Section Includes:
.1 Materials and installation for plumbing specialties and accessories.

1.2 REFERENCES

.1 American Society for Testing and Materials International (ASTM).
.1 ASTM A126-04(2009), Standard Specification for Gray Iron Castings for Valves, Flanges and Pipe Fittings.
.2 ASTM B62-09, Standard Specification for Composition Bronze or Ounce Metal Castings.

.2 Canadian Standards Association (CSA International).
.1 CSA B64 Series-11, Backflow Preventers and Vacuum Breakers.
.2 CSA B79-08, Floor, Area and Shower Drains, and Cleanouts for Residential Construction.
.3 Health Canada/Workplace Hazardous Materials Information System (WHMIS).
.1 Material Safety Data Sheets (MSDS).

1.3 SUBMITTALS

.1 Submittals in accordance with Section 01 33 00.

.2 Product Data:
.1 Submit manufacturer's printed product literature, specifications and datasheet for fixtures and equipment.
.2 Indicate dimensions, construction details and materials for specified items.

PART 2 - PRODUCTS

2.1 FLOOR DRAINS

.1 Floor Drains - Finished area "FD-1"
.1 All epoxy coated cast iron body with reversible clamp device and adjustable diameter 127 mm stainless steel 12 mm thick strainer, secured with stainless steel screws, 100 mm throat on strainer. In quarry or mosaic tiled areas provide square 150 mm x 150 mm stainless steel square 12 mm thick strainer.

2.1 FLOOR DRAINS (Cont'd)

.2 HD-1: Hub Drains

.1 All stainless steel body with reversible clamp device and adjustable 215 MM diameter top. Drain to be provided with stainless steel rim and grate with 220 x 95 x 115 MM high oval NB funnel and sediment bucket. Hub drain: to CSA B79.

2.2 CLEANOUTS

.1 Cleanout Plugs: heavy cast iron male ferrule with brass screws and threaded brass or bronze plug. Sealing-caulked lead seat or neoprene gasket.

.2 Access Covers:

.1 Wall Access: face or wall type, polished nickel bronze or stainless steel square and or roundcover with flush head securing screws, bevelled edge frame complete with anchoring lugs.

.2 Floor Access: rectangular round cast iron body and frame with adjustable secured nickel bronze top cast box with anchor lugs and:

.1 Plugs: bolted bronze with neoprene gasket.

.2 Cover for Unfinished Concrete Floors: cast iron nickel bronze round or square, gasket, vandal-proof screws.

.3 Cover for Terrazzo Finish: polished nickel bronze brass with recessed cover for filling with terrazzo, vandal-proof locking screws.

.4 Cover for Tile and Linoleum Floors: polished nickel bronze with recessed cover for linoleum or tile infill, complete with vandal-proof locking screws.

.5 Cover for Carpeted Floors: polished nickel bronze with deep flange cover for carpet infill, complete with carpet retainer vandal-proof locking screws.

2.3 WATER HAMMER ARRESTORS

.1 Stainless steel Copper construction, bellows piston type: to PDI-WH201.

2.4 BACK FLOW PREVENTERS

.1 Preventers: to CSA B64 Series, reduced pressure principle type double check valve assembly back flow preventer with intermediate atmospheric vent or vacuum breaker.

2.5 VACUUM BREAKERS

.1 Breakers: to CSA B64 Series, vacuum breaker atmospheric hose connection laboratory faucet intermediate.

2.6 WATER MAKE-UP ASSEMBLY

.1 Complete with backflow preventer pressure gauge on inlet and outlet, pressure reducing valve to CSA B356, pressure relief valve on low pressure side and gate valves on inlet and outlet.

2.7 TRAP SEAL PRIMERS

.1 Brass, with integral vacuum breaker, NPS 1/2 solder ends, NPS 1/2 drip line connection.

PART 3 - EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 INSTALLATION

.1 Install in accordance with National Plumbing Code of Canada provincial codes, and local authority having jurisdiction.

.2 Install in accordance with manufacturer's instructions and as specified.

3.3 CLEANOUTS

.1 Install cleanouts at base of soil and waste stacks, and rainwater leaders, at locations required code, and as indicated.

.2 Bring cleanouts to wall or finished floor unless serviceable from below floor.

3.4 WATER HAMMER ARRESTORS

.1 Install on branch supplies to fixtures or group of fixtures where indicated.

3.5 BACK FLOW PREVENTORS

.1 Install in accordance with CSA B64 Series, where indicated and elsewhere as required by code.

.2 Pipe discharge to terminate over nearest drain and or service sink.

3.6 TRAP SEAL PRIMERS

.1 Install for floor drains and elsewhere, as indicated.

.2 Install on cold water supply to nearest frequently used plumbing fixture, in concealed space, to Departmental Representative.

.3 Install soft copper plastic tubing to floor drain.

3.7 WATER MAKE-UP ASSEMBLY

.1 Install on valved bypass.

.2 Pipe discharge from relief valve to nearest floor drain.

3.8 TESTING AND ADJUSTING

.1 Testing and Adjusting as per following:
- .1 Timing:
  - .1 After start-up deficiencies rectified.
  - .2 Floor drains:
    - .1 Verify operation of trap seal primer.
    - .2 Prime, using trap primer. Adjust flow rate to suit site conditions.
    - .3 Check operations of flushing features.
    - .4 Check security, accessibility, removeability of strainer.
    - .5 Clean out baskets.
  - .3 Vacuum breakers, backflow preventers:
    - .1 Test tightness, accessibility for O&M of cover and of valve.
    - .2 Simulate reverse flow and back-pressure conditions to test operation of vacuum breakers, backflow preventers.
    - .3 Verify visibility of discharge from open ports.
  - .4 Access doors:
    - .1 Verify size and location relative to items to be accessed.

3.8 TESTING AND ADJUSTING (Cont'd)

.1 (Cont'd)

.1 (Cont'd)

.5 Cleanouts:

.1 Verify covers are gas-tight, secure, yet readily removable.

.6 Water hammer arrestors:

.1 Verify proper installation of correct type of water hammer arrester.

.7 Pressure regulators, PRV assemblies:

.1 Adjust settings to suit locations, flow rates, pressure conditions.

END

PART 1 - GENERAL

1.1 REFERENCES

.1 Canadian Standards Association (CSA International)
.1 CAN/CSA-B45 Series-02(R2008), Plumbing Fixtures.
.2 CSA B125.3-11, Plumbing Fittings.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00.

.2 Product Data:
.1 Provide manufacturer's printed product literature and datasheets for fixtures, and include product characteristics, performance criteria, physical size, finish and limitations.

1.3 CLOSEOUT SUBMITTALS

.1 Provide maintenance data in accordance with Section 01 78 00.

.2 Include:
.1 Description of fixtures and trim, giving manufacturer's name, type, model, year, capacity.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle in accordance with Section 01 61 00.

.2 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.

PART 2 - PRODUCTS

2.1 MANUFACTURED UNITS

.1 Fixtures: manufacture in accordance with CAN/CSA-B45 series.

.2 Trim, fittings: manufacture in accordance with CSA B125.3.

.3 Exposed plumbing brass to be chrome plated.

.4 Number, locations: architectural drawings to govern.

.5 Stainless steel counter-top sinks.

.1 S-1: single compartment, non-ledge back.

.1 From 1.0 mm thick type 302 stainless steel, self-rimming, undercoated, clamps. Inside sizes: 508 x 508 x 203 mm.

.2 Trim: chrome plated brass, with swing spout, aerator, single lever handle, washerless controls, accessories to limit maximum flow rate to 8.35 litres/minute at 413 kPa, with spray fitting.

.3 Supplies: chrome plated polished brass Faucet Supplies, heavy duty angle stops, 10mm I. P. S. Inlet x 76mm long rigid horizontal nipples, V. P. Loose keys, escutcheons and flexible copper risers or approved equal.

.1 P-Trap : 38mm size, box flange and seamless tubular wall bend. or approved equal.

.6 Fixture piping:

.1 Hot and cold water supplies to each fixture:

.1 Chrome plated flexible supply pipes each with handwheel stop, reducers, escutcheon.

.2 Waste:

.1 Brass P trap with clean out on each fixture not having integral trap.

.2 Chrome plated in all exposed places.

PART 3 - EXECUTION

3.1 APPLICATION

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

3.2 INSTALLATION

.1 Mounting heights:
.1 Standard: to comply with manufacturer's recommendations unless otherwise indicated or specified.

.2 Provide new isolating valves for the sink being replaced

3.3 ADJUSTING

.1 Conform to water conservation requirements specified this section.

.2 Adjustments:
.1 Adjust water flow rate to design flow rates.
.2 Adjust pressure to fixtures to ensure no splashing at maximum pressures.

.3 Checks:
.1 Aerators: operation, cleanliness.
.2 Vacuum breakers, backflow preventers: operation under all conditions.

END

PART 1 - GENERAL

1.1 RELATED SECTIONS

.1 Section 01 51 00 - Temporary Utilities.

.2 Temporary Facilities.

1.2 USE OF SYSTEMS

.1 Use of new and or existing permanent heating and or ventilatingsystems for supplying temporary heat or ventilation is not permitted permitted only under the following conditions:.

.1 Entire system is complete, pressure tested, cleaned, flushed out.

.2 Specified water treatment system has been commissioned, water treatment is being continuously monitored.

.3 Building has been closed in, areas to be heated/ventilated are clean and will not thereafter be subjected to dust-producing processes.

.4 There is no possibility of damage from any cause.

.5 Supply ventilation systems are protected by 60% filters, which shall be inspected daily, changed every week 2 weeks or more frequently as required.

.6 Return systems have approved filters over all openings, inlets, outlets.

.7 All systems will be:

.1 operated as per manufacturer's recommendations or instructions.

.2 operated by Contractor.

.3 monitored continuously by Contractor.

.8 Warranties and guarantees are not thereby relaxed.

.9 Regular preventive and all other manufacturers recommended maintenance routines are performed by Contractor at his own expense and under supervision of Departmental Representative Consultant.

.10 Before static completion, entire system to be refurbished, cleaned internally and externally, restored to "as- new" condition, filters in air systems replaced.

.2 Filters referred to herein are over and above those specified elsewhere in this specification.

.3 Exhaust systems are not included in any approvals for temporary heating ventilation.

PART 2 - PRODUCTS

2.1 NOT USED

.1 Not Used.

PART 3 - EXECUTION

3.1 NOT USED

.1 Not Used.

END

PART 1 - GENERAL

1.1 EQUIPMENT LIST

.1 Complete list of equipment and materials to be used on this project and forming part of bid documents by adding manufacturer's name, model number and details of materials, and submit for approval.

.2 Submit for approval within 10 days after Award of Contract.

1.2 TRIAL USAGE

.1 Departmental Representative Owner may use equipment and systems for test purposes prior to acceptance. Supply labour, material, and instruments required for testing.

1.3 PROTECTION OF OPENINGS

.1 Protect equipment and systems openings from dirt, dust, and other foreign materials with materials appropriate to system.

1.4 PAINTING

.1 Prime and touch up marred finished paintwork to match original.

.2 Restore to new condition, finishes which have been damaged too extensively to be merely primed and touched up.

1.5 DEMONSTRATION AND OPERATING AND MAINTENANCE INSTRUCTIONS

.1 Supply tools, equipment and personnel to demonstrate and instruct operating and maintenance personnel in operating, controlling, adjusting, trouble-shooting and servicing of all systems and equipment during regular work hours, prior to acceptance.

.2 Where specified elsewhere in Mechanical Divisions, manufacturers to provide demonstrations and instructions.

.3 Use operation and maintenance manual, as-built drawings, audio visual aids, etc. as part of instruction materials.

1.5 DEMONSTRATION AND OPERATING AND MAINTENANCE INSTRUCTIONS (Cont'd)

.4 Instruction duration time requirements as specified in appropriate sections.

.5 Where deemed necessary, Departmental Representative Owner may record these demonstrations on video tape for future reference.

1.6 CLOSEOUT SUBMITTALS

.1 Provide operation and maintenance data for incorporation into manual specified in Section 01 78 00.

.2 Operation and maintenance manual to be approved by, and final copies deposited with, Departmental Representative before final inspection.

.3 Operation data to include:
.1 Control schematics for each system including environmental controls.
.2 Description of each system and its controls.
.3 Description of operation of each system at various loads together with reset schedules and seasonal variances.
.4 Operation instruction for each system and each component.
.5 Description of actions to be taken in event of equipment failure.
.6 Valves schedule and flow diagram.
.7 Colour coding chart.

.4 Maintenance data shall include:
.1 Servicing, maintenance, operation and trouble-shooting instructions for each item of equipment.
.2 Data to include schedules of tasks, frequency, tools required and task time.

.5 Performance data to include:
.1 Equipment manufacturer's performance data sheets with point of operation as left after commissioning is complete.
.2 Equipment performance verification test results.
.3 Special performance data as specified elsewhere.
.4 Testing, adjusting and balancing reports as specified in Section 23 05 93.

1.6 CLOSEOUT SUBMITTALS (Cont'd)

.6 Approvals:
.1 Submit 2 copies of draft Operation and Maintenance Manual to Departmental Representative for approval. Submission of individual data will not be accepted unless so directed by Departmental Representative.
.2 Make changes as required and re-submit as directed by Departmental Representative.

.7 Additional data:
.1 Prepare and insert into operation and maintenance manual when need for same becomes apparent during demonstrations and instructions specified above.

1.7 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings and product data in accordance with Section 01 33 00.

.2 Shop drawings and product data shall show:
.1 Mounting arrangements.
.2 Operating and maintenance clearances. eg. access door swing spaces.

.3 Shop drawings and product data shall be accompanied by:
.1 Detailed drawings of bases, supports, and anchor bolts.
.2 Acoustical sound power data, where applicable.
.3 Points of operation on performance curves.
.4 Manufacturer to certify as to current model production.
.5 Certification of compliance to applicable codes.

.4 In addition to transmittal letter referred to in Section 01 33 00: use MCAC "Shop Drawing Submittal Title Sheet". Identify section and paragraph number.

1.8 CLEANING

.1 Clean interior and exterior of all systems including strainers. Vacuum interior of ductwork and air handling units.

1.9 AS-BUILT DRAWINGS

.1 Site records:
.1 Departmental Representative will provide 1 set of reproducible mechanical drawings. Provide sets of white prints as required for each phase of the work. Mark there on all changes as work progresses and as changes occur. This shall include changes to existing mechanical systems, control systems and low voltage control wiring.
.2 On a weekly basis, transfer information to reproducibles, revising reproducibles to show all work as actually installed.
.3 Use different colour waterproof ink for each service.
.4 Make available for reference purposes and inspection at all times.

.2 As-built drawings:
.1 Prior to start of Testing, Adjusting and Balancing (TAB), finalize production of as-built drawings.
.2 Identify each drawing in lower right hand corner in letters at least 12 mm high as follows: - "AS BUILT DRAWINGS: THIS DRAWING HAS BEEN REVISED TO SHOW MECHANICAL SYSTEMS AS INSTALLED" (Signature of Contractor) (date).
.3 Submit to Departmental Representative for approval and make corrections as directed.
.4 TAB to be performed using as-built drawings.
.5 Submit completed reproducible as-built drawings with Operating and Maintenance Manuals.

.3 Submit copies of as-built drawings for inclusion in final TAB report.

.4 as-built drawings for inclusion in final TAB report.

.5 As-built drawings shall be all converted to AutoCAD with PWGSC layering system.

.6 Submit as-built AutoCAD and PDF CD/DVD/Flash Drive. Allow for minimum two (2) sets.

.7 All TAB reports shall be in PDF format and copied to CD/DVD/Flash Drive and folder prints.

1.10 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Section 01 11 01.

.2 Divert unused metal and wiring materials from landfill to metal recycling facility approved by Departmental Representative.

.3 Dispose of unused paint material at official hazardous material collections site approved by Departmental Representative.

.4 Do not dispose of unused paint material into sewer system, into streams, lakes, onto ground or in other locations where it will pose health or environmental hazard.

.5 Remove from site and dispose of packaging materials at appropriate recycling facilities.

.6 Dispose of corrugated cardboard, polystyrene, plastic packaging material in appropriate on-site bin for recycling in accordance with site waste management program.

1.11 EXAM SITE

.1 Examine the site and the local conditions and Conditions affecting the work during tender process. Examine carefully the Architectural, Structural, and Mechanical, Electrical and all other drawings and the complete specifications to ensure that the work can be satisfactorily carried out as shown.

.2 Before commencing work, examine the work of the other Divisions and report at once any defect or interference affecting the work, the completion, or the guarantee of the work of this Division. No allowance will be made later for any expenses incurred through the failure to make these examinations or to report any such discrepancies in writing to the Department Representative.

1.12 CODES, PERMITS FEES ANC CONNECTIONS

.1 Conform to Federal, Provincial and Municipal regulations and perform work in accordance with requirements of By Laws and Regulations in force in area where the building is to be erected.

.2 Apply for, obtain, and pay for permits, fees and service connections for the work of this

1.12 CODES, PERMITS FEES ANC CONNECTIONS (Cont'd)

.2 (Cont'd)
Division and the inspections required by Authorities having jurisdiction in the area where the building is to be erected.

.3 For information, a specific code or standard might be mentioned. This information must not be taken as the only code or standard applicable.

.4 When part of equipment does not bear the required UL label, the contractor shall obtain UL approval on site, when that part of the equipment is an electric component, a special approval shall be obtained and the Contractor shall pay the applicable fees.

.5 Furnish necessary certificates as evidence that the work installed conforms with laws and regulations of Authorities having jurisdiction. Changes in work requested by an Authority having jurisdiction shall be carried out without charge.

.6 Apply to TSSA for high pressure application. Ensure all systems are tested to TSSA satisfaction.

1.13 INSTALLATION OF WORK

.1 Coordinate with other trades and schedule all work to suit the date for the substantial performance established in the construction contract.

.2 Furnish items to be "built up" in ample time and give necessary information and assistance in connection with the building in of the same.

.3 Provide drawings showing all sleeving and openings required. Notify the Construction Manager of the size and location of recesses, openings and chases before walls, floors, etc., are erected.

.4 Proceed with the work as quickly as practical so that construction may be completed in as short a time as possible and in accordance with the building schedule. Ensure that all health, safety and environmental conditions are maintained.

1.13 INSTALLATION OF WORK (Cont'd)

.4 (Cont'd)

.5 Ensure that all equipment and material is ordered in time to meet the building schedule. Provide a schedule of equipment deliveries to the Construction Manager within the time limit stipulated.

.6 Furnish promptly information required for the construction schedule.

.7 Manufactured products supplied with instructions for their installation shall be installed in strict accordance with those instructions.

1.14 WORK IN EXISTING BUILDINGS

.1 Prior to working on any of exiting systems, contact Departmental Representative and provide with at least 5 working days notice .

.2 Do not disturb any hydraulic piping without through examination to ensure it is safe and empty. Ensure isolating valves are operational prior to carrying out any work.

.3 Freeze lines if required to make required connections.

1.15 SLEEVES

.1 Use cast iron sleeve or steel pipe sleeves with annular fin continuously welded at midpoint.

.2 For pipes passing through roofs, use cast iron sleeves with caulking recess and flashing clamp device. Anchor sleeves in roof construction; caulk between sleeve recess and pipe; fasten roof flashing to clamp device; make water tight durable joint.

1.15 SLEEVES (Cont'd)

.3 Fill voids around pipes

.1 For sleeves and pipe in foundation walls and below grade floors, provide "link seal@ clamp manufactured by Thunderline or Innerlynx.

.2 Where sleeves pass through walls or floors, caulk space between insulation and sleeve or between pipe (duct) and sleeve with waterproof fire retardant non hardening mastic. Seal space at each end of sleeve with waterproof, fire retardant, non hardening mastic.

.3 Ensure no contact between copper tube or pipe and ferrous sleeve.

.4 Fill future use sleeves with easily removable fire stop filler.

.5 Coat exposed exterior surfaces of ferrous sleeves with heavy application of zinc rich paint.

.4 All sleeves shall be as detailed on drawings.

.5 All sleeve locations including dimensions shall be submitted to the Department Representative.

1.16 TESTS

.1 Do not insulate or conceal work until tested and approved. Follow construction schedule and arrange for tests.

.2 Inform the Department Representative when tests will be conducted. All tests are to be documented test results submitted and included in the maintenance manuals. Refer to attached Appendix A for the format to be utilized for the test reports.

.3 Bear costs including retesting and making good.

.4 Prior to tests, isolate all equipment or other parts which are not designed to withstand test pressures.

PART 2 - PRODUCTS

2.1 NOT USED

.1 Not Used.

PART 3 - EXECUTION

3.1 CUTTING AND PATCHING

.1 Cutting and patching shall be in accordance with the following:

.1 No openings shall be permitted through the completed structure without the written approval of the Department Representative. Any openings which are required through structure must be clearly and accurately shown. Exact locations, elevations and size of the proposed opening must be identified and submitted to the Department Representative for review, well in advance of doing the work.

.2 All cutting and patching shall be done by the trades specializing in the materials to be cut and is covered by the appropriate Divisions of this specification. Prepare drawings in conjunction with all trades concerned, showing sleeves and openings for passage through structure and all insert sizes and locations.

.3 Supporting members of any floor, wall or the building structure shall be cut only in such a location and manner as approved by the Department Representative in writing.

.4 Scan and x-ray floors prior to carrying out any openings. Rebars shall not be cut.

END

PART 1 - GENERAL

1.1 REFERENCES

.1 Canadian General Standards Board (CGSB)
.1 CAN/CGSB-1.181-99, Ready-Mixed Organic Zinc-Rich Coating.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00.

1.3 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle in accordance with Section 01 61 00.

.2 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.

PART 2 - PRODUCTS

2.1 NOT USED

.1 Not Used.

PART 3 - EXECUTION

3.1 APPLICATION

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

3.2 CONNECTIONS TO EQUIPMENT

.1 In accordance with manufacturer's instructions unless otherwise indicated.

.2 Use valves and either unions or flanges for isolation and ease of maintenance and assembly.

.3 Use double swing joints when equipment mounted on vibration isolation and when piping subject to movement.

3.3 CLEARANCES

.1 Provide clearance around systems, equipment and components for observation of operation, inspection, servicing, maintenance and as recommended by manufacturer.

.2 Provide space for disassembly, removal of equipment and components as recommended by manufacturer or as indicated (whichever is greater) without interrupting operation of other system, equipment, components.

3.4 DRAINS

.1 Install piping with grade in direction of flow except as indicated.

.2 Install drain valve at low points in piping systems, at equipment and at section isolating valves.

.3 Pipe each drain valve discharge separately to above floor drain. Discharge to be visible.

.4 Drain valves: NPS 3/4 ball valves unless indicated otherwise, with hose end male thread, cap and chain.

3.5 AIR VENTS

.1 Install manual air vents at high points in piping systems.

.2 Install isolating valve at each automatic air valve.

.3 Install drain piping to approved location and terminate where discharge is visible.

3.6 DIELECTRIC COUPLINGS

.1 General: compatible with system, to suit pressure rating of system.

.2 Locations: where dissimilar metals are joined.

.3 NPS 2 and under: isolating unions or bronze valves.

.4 Over NPS 2: isolating flanges.

3.7 PIPEWORK INSTALLATION

.1 Screwed fittings jointed with Teflon tape.

.2 Protect openings against entry of foreign material.

.3 Install to isolate equipment and allow removal without interrupting operation of other equipment or systems.

.4 Assemble piping using fittings manufactured to ANSI standards.

.5 Install exposed piping, equipment, rectangular cleanouts and similar items parallel or perpendicular to building lines.

.6 Install concealed pipework to minimize furring space, maximize headroom, conserve space.

.7 Slope piping, except where indicated, in direction of flow for positive drainage and venting.

.8 Install, except where indicated, to permit separate thermal insulation of each pipe.

.9 Group piping wherever possible and as indicated.

.10 Ream pipes, remove scale and other foreign material before assembly.

.11 Use eccentric reducers at pipe size changes to ensure positive drainage and venting.

.12 Provide for thermal expansion as indicated.

.13 Valves:
.1 Install in accessible locations.
.2 Remove interior parts before soldering.
.3 Install with stems above horizontal position unless otherwise indicated.
.4 Valves accessible for maintenance without removing adjacent piping.
.5 Install globe valves in bypass around air handling unit control valves.
.6 Use ball or butterfly valves at branch take-offs for isolating purposes except where otherwise specified.
.7 Install butterfly valves on chilled water only.
.8 Install butterfly valves between weld neck flanges to ensure full compression of liner.

3.7 PIPEWORK INSTALLATION (Cont'd)

.13 Valves:(Cont'd)
.9 Install plug cocks or ball valves for glycol service.
.10 Use chain operators on valves NPS 2 1/2 and larger where installed more than 2400 mm above floor in Mechanical Rooms.

.14 Check Valves:
.1 Install silent check valves on discharge of pumps and in vertical pipes with downward flow and elsewhere as indicated.
.2 Install swing check valves in horizontal lines on discharge of pumps and elsewhere as indicated.

3.8 SLEEVES

.1 General: install where pipes pass through masonry, concrete structures, fire rated assemblies, and elsewhere as indicated.

.2 Material: schedule 40 black steel pipe.

.3 Construction: foundation walls and where sleeves extend above finished floors to have annular fins continuously welded on at mid-point.

.4 Sizes: 6 mm minimum clearance between sleeve and uninsulated pipe or between sleeve and insulation.

.5 Installation:
.1 Concrete, masonry walls, concrete floors on grade: terminate flush with finished surface.
.2 Other floors: terminate 25 mm above finished floor.
.3 Before installation, paint exposed exterior surfaces with heavy application of zinc-rich paint to CAN/CGSB-1.181.

.6 Sealing:
.1 Elsewhere: Provide space for firestopping. Maintain fire rating integrity.
.2 Ensure no contact between copper pipe or tube and sleeve.

3.9 ESCUTCHEONS

.1 Install on pipes passing through walls, partitions, floors, and ceilings in finished areas.

3.9 ESCUTCHEONS (Cont'd)

.2 Construction: one piece type with set screws. Chrome or nickel plated brass or type 302 stainless steel.

.3 Sizes: outside diameter to cover opening or sleeve. Inside diameter to fit around pipe or outside of insulation if so provided.

3.10 PREPARATION FOR FIRE STOPPING

.1 Material and installation within annular space between pipes, ducts, insulation and adjacent fire separation.

.2 Uninsulated unheated pipes not subject to movement: No special preparation.

.3 Uninsulated heated pipes subject to movement: wrap with non-combustible smooth material to permit pipe movement without damaging fires topping material or installation.

.4 Insulated pipes and ducts: ensure integrity of insulation and vapour barriers.

3.11 FLUSHING OUT OF PIPING SYSTEMS

.1 Flush system in accordance with Section 23 08 02.

.2 Before start-up, clean interior of piping systems in accordance with requirements of Section 01 74 11 supplemented as specified in relevant mechanical sections.

.3 Preparatory to acceptance, clean and refurbish equipment and leave in operating condition, including replacement of filters in piping systems.

3.12 PRESSURE TESTING OF EQUIPMENT AND PIPEWORK

.1 Advise Departmental Representative 48 hours minimum prior to performance of pressure tests.

.2 Pipework: test as specified in relevant sections of heating, ventilating and air conditioning work.

.3 Maintain specified test pressure without loss for 4 hours minimum unless specified for longer period of time in relevant mechanical sections.

3.12 PRESSURE TESTING OF EQUIPMENT AND PIPEWORK (Cont'd)

.4 Prior to tests, isolate equipment and other parts which are not designed to withstand test pressure or media.

.5 Conduct tests in presence of Departmental Representative.

.6 Pay costs for repairs or replacement, retesting, and making good. Departmental Representative to determine whether repair or replacement is appropriate.

.7 Insulate or conceal work only after approval and certification of tests by Departmental Representative.

3.13 EXISTING SYSTEMS

.1 Connect into existing piping systems at times approved by Departmental Representative.

.2 Request written approval 10 days minimum, prior to commencement of work.

.3 Be responsible for damage to existing plant by this work.

.4 Ensure daily clean-up of existing areas.

3.14 CLEANING

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

END

PART 1 - GENERAL

1.1 REFERENCES

.1 American Society of Heating, Refrigeration and Air-Conditioning Engineers (ASHRAE)
.1 ANSI/ASHRAE 90.1-2010, SI; Energy Standard for Buildings Except Low-Rise Residential Buildings (ANSI/ASHRAE/IES).

.2 Electrical Equipment Manufacturers' Advisory Council (EEMAC)

1.2 SECTIONS INCLUDES

.1 Electrical work to conform to Electrical Divisions including the following:
.1 Supplier and installer responsibility is indicated in Motor, Control and Equipment Schedule on electrical drawings and related mechanical responsibility is indicated on Mechanical Equipment Schedule on mechanical drawings.
.2 Control wiring and conduit is specified in Division 26 except for conduit, wiring and connections below 50 V which are related to control systems specified in Division 23. Refer to Division 26 for quality of materials and workmanship.

1.3 SHOP DRAWINGS

.1 Submit shop drawings in accordance with Section 01 33 00.

1.4 CLOSEOUT SUBMITTALS

.1 Provide maintenance data for motors, drives and guards for incorporation into manual specified in Section 01 33 00.

1.5 WASTE MANAGEMENT AND DISPOSAL

.1 Refer to Section 01 74 20.

PART 2 - PRODUCTS

2.1 GENERAL

.1 Motors to be high efficiency, in accordance with local Hydro company standards and the requirements of ASHRAE 90.1.

2.2 MOTORS

.1 Provide motors for mechanical equipment as specified.

.2 Replace motor for existing return fan, as indicated on the drawings.

.2 If delivery of specified motor will delay delivery or installation of equipment, install motor approved by Departmental Representative for temporary use. Final acceptance of equipment will not occur until specified motor is installed.

.3 Motors under 373 W (1/2 HP): speed as indicated, continuous duty, built-in overload protection, resilient mount, single phase, 120 V, unless otherwise specified or indicated.

.4 Motors 373 W (1/2 HP) and larger: EEMAC Class B, squirrel cage induction, speed as indicated, continuous duty, drip proof, ball bearing, maximum temperature rise 40 ° C, 3 phase, 600 V, unless otherwise specified or indicated.

.5 All motors shall be 1750 rpm unless otherwise noted.

.6 All motors shall be high efficiency, suitable for full voltage starting, rated for the voltage indicated in the schedule and shall have a service factor of 1.15. For the VFD applications motors shall be inverter duty, rated for service factor of 1.25.

.7 All motors shall have minimum NEMA Class F insulation systems or be rated for VFD application (when applicable). All motors shall be capable of supplying nameplate and service factor horsepower ratings on a continuous basis without exceeding the 105°C temperature rise in a 40°C ambient temperature.

2.2 MOTORS (Cont'd)

.8 The temperature rises described above are based upon measurements by the resistance method. These limits shall not be exceeded when the voltage and frequency applied to motors are within the limitations of NEMA MG1.

.9 All motors shall have copper stator windings and motor leads.

.10 Aluminum die-cast rotor assemblies shall be provided, if available.

.11 Where aluminum die-cast rotor assemblies are not provided, rotor bars and conducting end rings shall be made of copper or copper alloys, with the bars welded or brazed to the rings. No phosphorous brazing materials may be used.

.12 Motors 3 HP and above shall be constructed to IEEE 841 standards and shall carry IEEE 841 certifications. Motors without IEEE 841 certifications and labeling shall be replaced by the contractor at their costs.

2.3 TEMPORARY MOTORS

.1 If delivery of specified motor will delay completion or commissioning work, install motor approved by Departmental Representative for temporary use. Work will only be accepted when specified motor is installed.

2.4 BELT DRIVES

.1 Fit reinforced belts in sheave matched to drive. Multiple belts to be matched sets.

.2 Use cast iron or steel sheaves secured to shafts with removable keys unless otherwise specified.

.3 For motors under 7.5 kW (10 HP): standard adjustable pitch drive sheaves, having plus or minus 10% range. Use mid-position of range for specified r/min.

.4 For motors 7.5 kW (10) HP and over: sheave with split tapered bushing and keyway having fixed pitch unless specifically required for item concerned. Provide sheave of correct size to suit balancing.

.5 Correct size of sheave to be determined during commissioning.

2.4 BELT DRIVES (Cont'd)

.6 Minimum drive rating: 1.5 times nameplate rating on motor. Keep overhung loads within manufacturer's design requirements on prime mover shafts.

.7 Motor slide rail adjustment plates to allow for centre line adjustment.

.8 Supply one set of spare belts for each set.

2.5 DRIVE GUARDS

.1 Provide guards for unprotected drives.

.2 Guards for belt drives;
.1 Expanded metal screen welded to steel frame.
.2 Minimum 1.2 mm thick sheet metal tops and bottoms.
.3 38 mm dia holes on both shaft centres for insertion of tachometer.
.4 Removable for servicing.

.3 Provide means to permit lubrication and use of test instruments with guards in place.

.4 Install belt guards to allow movement of motors for adjusting belt tension.

.5 Guard for flexible coupling:
.1 "U" shaped, minimum 1.6 mm thick galvanized mild steel.
.2 Securely fasten in place.
.3 Removable for servicing.

.6 Unprotected fan inlets or outlets:
.1 Wire or expanded metal screen, galvanized, 19 mm mesh.
.2 Net free area of guard: not less than 80% of fan openings.
.3 Securely fasten in place.
.4 Removable for servicing.

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Fasten securely in place.

.2 Make removable for servicing, easily returned into, and positively in position.

END

PART 1 - GENERAL

1.1 REFERENCES

.1 American Society of Heating, Refrigeration and Air-Conditioning Engineers (ASHRAE)
.1 ASHRAE 90.1-2010, Energy Standard for Buildings Except Low-Rise Residential Buildings (IESNA cosponsored; ANSI approved; Continuous Maintenance Standard).

.2 Electrical Equipment Manufacturers' Association Council (EEMAC)

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

.4 Material Safety Data Sheets (MSDS).

.5 All drives shall be certified by cUL or CSA/UL approved.

1.2 DEFINITIONS

.1 Supplier and installer responsibility indicated in Motor, Control and Equipment Schedule on electrical drawings and related mechanical responsibility is indicated on Mechanical Equipment Schedule on mechanical drawings.

.2 Control wiring and conduit is specified in Division 26 except for conduit, wiring and connections below 120 V which are related to control systems specified in Division 22 and 23. Refer to Division 26 for quality of materials and workmanship

1.3 SUBMITTALS

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

.2 Product Data:
.1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 33 00 - Submittal Procedures. Include product characteristics, performance criteria, and limitations.
.1 Submit two copies of Workplace Hazardous Materials Information System (WHMIS) Material Safety Data Sheets (MSDS) in accordance with Section 01 33 00 - Submittal Procedures.

1.3 SUBMITTALS (Cont'd)

.2 Product Data:(Cont'd)
.2 Submittals to include following:
.1 Control schematics and external connection diagram showing function and identification of all terminals requiring field connections
.2 Technical description including list of options being provided.

.3 Quality Control: in accordance with Section 01 45 00 - Quality Control.
.1 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
.2 Instructions: submit manufacturer's installation instructions.
.1 Departmental Representative will make available 1 copy of systems supplier's installation instructions.

.4 Closeout Submittals
.1 Provide maintenance data for motors, drives and guards for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

1.4 QUALITY ASSURANCE

.1 Regulatory Requirements: work to be performed in compliance with CEPA, CEAA, TDGA, and applicable Provincial regulations.

.2 Health and Safety Requirements: do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.

1.5 DELIVERY, STORAGE, AND HANDLING

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

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

1.5 DELIVERY, STORAGE, AND HANDLING (Cont'd)

.2 Waste Management and Disposal:(Cont'd)
.1 (Cont'd)

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PART 2 - PRODUCTS

2.1 VARIABLE FREQUENCY DRIVES GENERAL

.1 Furnish complete variable frequency drives (VFD) for the following: All standard and optional features shall be included within the VFD enclosure. VFD enclosure shall be in heavy gauge metal NEMA 1. The entire package shall be UL and CSA approved.
.1 air handling being replaced.
.2 existing return fan.

.2 The VFD shall convert three-phase, 60 HZ utility power to adjustable voltage and frequency, three phase power for stepless motor speed control. The input voltage shall be as specified on the drawing schedules.

.3 The VFD shall include a converter and an inverter section. The converter section shall convert fixed frequency and voltage AC utility power to DC voltage. All VFD's shall include input line reactors.

.4 The inverter section of the VFD shall invert the DC voltage into a quality output waveform with adjustable voltage and frequency for stepless motor speed control. The VFD shall maintain a constant V/HZ. ratio.

.5 Power line noise shall be limited to a voltage distortion factor and line notch depth as defined in IEEE Standard 519-19851, Guide for Harmonic Control. The total voltage distortion shall not exceed 5%. The total current harmonic distortion shall be less than 10 percent.

.6 VFD's shall include filtration to limit Electromagnetic Interference and eliminate compatibility issues with sensitive computer equipment. All VFD's shall be provided in all metal enclosures to limit Radio Frequency Interference. The VFD shall not emit radiated RFI in excess of the limitations set forth in

2.1 VARIABLE FREQUENCY DRIVES GENERAL (Cont'd)

.6 (Cont'd)
the FCC Rules, Part 15 for Class A computing devices. PWM drives shall include RFI filters.

.7 The VFD drive shall have the ability of trending the faults (Data log) for troubleshooting and the trouble history. These information shall be stored with sufficient information to draw conclusions on the cause of diverse faults.

.8 Supplied VFD's shall be match existing drives on site. Existing drives are all Alan Bradley Power Flex 70.

2.2 PROTECTIVE FEATURES

.1 Motor overload protection for each motor controlled.

.2 Protection against:
.1 Input power under and over voltage, phase loss.
.2 Output current overload and instantaneous over current.
.3 Over temperature within VFD enclosure.
.4 Over voltage on the DC bus.
.5 Sustained power or phase loss.
.6 Line side voltage distortion not to exceed 3 percent.
.7 Line side current distortion not to exceed 8%.

.3 Automatically reset faults due to under voltage, phase loss, over voltage and Over temperature.

.4 Protection against output short circuit and motor winding shorting to cause faults, as defined by UL508.

.5 Status lights or digital display (English & French language to be selected on the control panel) of individual faults.

.6 Controller capable of operating without a motor to facilitate start-up and troubleshooting.

.7 Input and output line reactors shall be provided to minimize harmonics reduced to the AC line and to provide protection to AC line transients.

2.2 PROTECTIVE FEATURES (Cont'd)

.8 Motors

.1 All motors operated by VFD drives shall meet the NEMA MG1, Part 31 standards for operation without filtration. If VFD output exceeds MG1, Part 31 standards additional LC filter Networks shall be included with each VFD.

.9 Fire Alarm Connection

.1 Provide contact for fire alarm shut down and fire alarm start up in case of fire alarm, for connection from the fire alarm panel.

.10 Interface Features:

.1 Door mounted Hand/Off/Auto selector switch.

.2 Door mounted, interlocked, padlockable disconnect switch. This disconnect switch shall disconnect the drive from the input power line.

.3 Local/Remote selector switch. In the remote position motor speed is determined by the follower signal. In the local position motor speed is determined by a manual switch mounted on the panel faceplate.

.4 Power "ON" light.

.5 Fault lights to indicate that the VFD has tripped on a fault condition.

.6 Digital meter to indicate percent speed and percent load.

.7 Form C dry contacts to indicate when the VFD is in the run mode and to indicate when the VFD is in the fault mode.

.8 A 0-10 Vdc signal proportional to the speed.

.9 Safety shutdown from safety contacts (smoke, freeze) in drive or bypass mode.

.10 VFD shall accept 4 - 20ma, 0-10 Vdc control signal.

.11 All alarms shall read out in full English & French language to be selected on the control panel coded messages are not acceptable.

.11 Adjustments

.1 Maximum speed (50-100% base), minimum (0-50% base).

.2 Acceleration time, adjustable 3 to 300 sec.

.3 Deceleration time, adjustable 3 to 300 sec.

.4 Current limit, adjustable 0 to 105%.

.5 Overload trip setpoint.

.6 Offset and gain to condition the input speed signal.

2.2 PROTECTIVE FEATURES (Cont'd)

.12 Service Conditions

.1 Ambient temperature -10 to 40 deg. C. Units located in non-heated areas shall be provided with thermostically controlled heater weather enclosure.

.2 0 to 95% RH non condensing.

.3 Elevation to 1000 meters without derating.

.4 AC line voltage variation, -10 to +10% nominal.

.13 Quality Assurance

.1 To ensure quality the complete VFD shall be tested at the manufacturer's factory. The VFD shall operate a dynamometer at full load and the speed shall be cycled during the test.

.2 All optional features shall be functionally tested at the factory for proper operation.

.14 Automatic Bypass

.1 Provide by-pass for systems supply and return.

.2 Provide bypass consisting of a door interlocked main fused disconnect padlockable in the off position, a built in motor starter and a four position DRIVE/OFF/LINE/TEST switch controlling three contactors. In the DRIVE position the motor the motor shall be operated at an adjustable speed from the drive. In the OFF position the motor and drive are disconnected. In the LINE position, the motor is operated at full speed from the AC power line and power is disconnected from the drive. In the TEST position, the motor is operated at full speed from the AC line power. This allows the drive to be given an operating test while continuing to run the motor at full speed in bypass. Provide required fuses for bypass.

.3 Remote safety contacts shall be interlocked with the VFD's safety trip circuitry to stop the motor whether in the DRIVE OR BYPASS mode in case of an external safety fault.

.4 For all Variable Frequency Drives over 50 HP provide a soft start in the bypass starter.

.5 When the disconnect switch for the variable speed drive is shut off it shall not disconnect the power from the bypass.

.15 Communication With The BAS

.1 The variable frequency drives shall communicate with the Building Automation System (BAS) utilizing BACNET and/or Modbus RTU. Decision to be finalized at shop drawing stage.

2.2 PROTECTIVE FEATURES (Cont'd)

.15 (Cont'd)

.2 All items other than the signal to speed up / slow down the variable frequency drive shall be provided either through the BACNET connection or Modbus RTU. The signal to speed up / slow down the drive shall be controlled by a hard wired connection from the BAS.

.3 The following points for the drive shall be provided at the EMCAS.

- .1 Binary Inputs to Drive
  - .1 Remote Start/Stop command
- .2 Analog Outputs from Drive
  - .1 Reference (% speed)
  - .2 Frequency (Hz)
  - .3 Motor Current (Amps)
  - .4 Power (KW)
  - .5 Hours Run
- .3 Binary Outputs from Drive
  - .1 KWH Counter (KW consumption)
  - .2 Motor Run Status
  - .3 Tripped Status
  - .4 External Fault (Safety Interlock)
- .4 Minimum Speed Settings
  - .1 The minimum speed setpoints for the variable speed drives shall be as follows:
  - .2 Motor in the Airstream - 30%
  - .3 Motor out of the Airstream - 40%

PART 3 - EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 INSTALLATION

.1 Install in accordance with manufacturers recommendations.

.2 Properly ground the electrical system as per manufacturer's instructions.

.3 Provide a separate steel conduit/shielded wiring for all supply, line load and control wiring.

.4 For wiring and scope of work refer to Section 26 05 01 and Section 21 05 01.

3.2 INSTALLATION (Cont'd)

.5 Install the drive not more than 10 metres from the motor. The length of wiring connection shall not exceed 10 metres. Provide support for the variable frequency drive in the vicinity of the motor as required.

3.3 START-UP SERVICE

.1 The manufacturer shall provide start-up commissioning of the variable frequency drive and its optional circuits by a factory trained certified technician. The commissioning personnel shall be the same personnel that will provide service and warranty repairs at the customer's site.

.2 The manufacturer shall provide minimum of four session each four hours of customer operator training on operation and service diagnostics at the time of equipment commissioning.

.3 Drive manufacturer shall provide as much assistance is required to the air and hydronic balance contractor to set the drives to provide the specified air flow.

3.4 DISCONNECT SWITCHES

.1 Disconnect switches wired between the VFD and the motor shall be provided with auxiliary contacts which shall be wired into the VFD's safety trip circuitry such that the VFD shall de-energize when the switch is opened. When the switch is closed the VFD shall energize and go through normal start up routines.

3.5 FIELD QUALITY CONTROL

.1 Site Tests: conduct following tests in accordance with Section 01 45 00 - Quality Control and submit report as described in Section 01 78 00 - Closeout Submittals.

.2 Manufacturer's Field Services:
.1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Field Reports as described in PART 1 - SUBMITTALS.
.2 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.

3.5 FIELD QUALITY CONTROL (Cont'd)

.2 Manufacturer's Field Services:(Cont'd)

.3 Schedule site visits, to review Work, as directed in Section 01 78 00 - Closeout Submittals.

3.6 CLEANING

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

.2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END

PART 1 - GENERAL

1.1 REFERENCES

.1 American Society of Mechanical Engineers (ASME)
.1 ASME B40.100-2005, Pressure Gauges and Gauge Attachments.
.2 ASME B40.200-2008, Thermometers, Direct Reading and Remote Reading.

.2 Canada Green Building Council (CaGBC)
.1 LEED Canada-NC Version 1.0-2004, LEED (Leadership in Energy and Environmental Design): Green Building Rating System Reference Package For New Construction and Major Renovations (including Addendum 2007).
.2 LEED Canada-CI Version 1.0-2007, LEED (Leadership in Energy and Environmental Design): Green Building Rating System Reference Guide For Commercial Interiors.

.3 Canadian General Standards Board (CGSB)
.1 CAN/CGSB-14.4-M88, Thermometers, Liquid-in-Glass, Self Indicating, Commercial/Industrial Type.
.2 CAN/CGSB-14.5-M88, Thermometers, Bimetallic, Self-Indicating, Commercial/Industrial Type.

.4 Efficiency Valuation Organization (EVO)
.1 International Performance Measurement and Verification Protocol (IPMVP)
.1 IPMVP 2007 Version.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00.

.2 Product Data:
.1 Submit manufacturer's instructions, printed product literature and data sheets for thermometers and pressure gauges and include product characteristics, performance criteria, physical size, finish and limitations.

1.3 DELIVERY, STORAGE AND HANDLING

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

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

PART 2 - PRODUCTS

2.1 GENERAL

.1 Design point to be at mid-point of scale or range.

.2 Ranges: as indicated.

2.2 DIRECT READING THERMOMETERS

.1 Industrial, variable angle type, mercury-free, liquid filled, 125 mm scale length: to CAN/CGSB-14.4 ASME B40.200.
.1 Resistance to shock and vibration.

2.3 REMOTE READING THERMOMETERS

.1 100 mm diameter mercury-free liquid filled vapour activated dial type: to CAN/CGSB-14.5 ASME B40.200, accuracy within one scale division, brass movement, stainless steel capillary, stainless steel spiral armour, stainless steel bulb and polished brass or stainless steel case for wall mounting.

2.4 THERMOMETER WELLS

.1 Copper pipe: copper or bronze.

.2 Steel pipe: brass or stainless steel.

2.5 PRESSURE GAUGES

.1 112 mm, dial type: to ASME B40.100, Grade 2A, stainless steel phosphor bronze bourdon tube having 0.5% accuracy full scale unless otherwise specified.

.2 Provide:
.1 Snubber for pulsating operation.
.2 Gasketted pressure relief back with solid front.
.3 Bronze stop cock.
.4 Oil filled for high vibration applications.

PART 3 - EXECUTION

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for installation in accordance with manufacturer's written instructions.
.1 Visually inspect substrate in presence of Departmental Representative.
.2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 GENERAL

.1 Install thermometers and gauges so they can be easily read from floor or platform.
.1 If this cannot be accomplished, install remote reading units.

.2 Install between equipment and first fitting or valve.

3.3 THERMOMETERS

.1 Install in wells on piping. Include heat conductive material inside well.

.2 Install in locations as indicated and on inlet and outlet of:
.1 Heat exchangers.
.2 Water heating and cooling air handling coils.

.3 Install wells as indicated only for balancing purposes.

.4 Use extensions where thermometers are installed through insulation.

3.4 PRESSURE GAUGES

.1 Install in locations as follows:
.1 Suction and discharge of pumps.
.2 Upstream and downstream of PRV's.
.3 Upstream and downstream of air handling unitcontrol valves.

3.4 PRESSURE GAUGES (Cont'd) .1 (Cont'd)

.4 Inlet and outlet of air handling unit coils.

.5 In other locations as indicated.

.2 Install gauge cocks for balancing purposes, elsewhere as indicated.

.3 Use extensions where pressure gauges are installed through insulation.

3.5 NAMEPLATES .1 Install engraved lamicoid nameplates in accordance with Section 23 05 53.01, identifying medium.

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

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

END

PART 1 - GENERAL

1.1 REFERENCES

.1 American Society of Mechanical Engineers (ASME)
.1 ASME B1.20.1-1983(R2006), Pipe Threads, General Purpose (Inch).
.2 ASME B16.18-2001, Cast Copper Alloy Solder Joint Pressure Fittings.

.2 ASTM International
.1 ASTM A276-10, Standard Specification for Stainless Steel Bars and Shapes.
.2 ASTM B62-09, Standard Specification for Composition Bronze or Ounce Metal Castings.
.3 ASTM B283/B283M-11a, Standard Specification for Copper and Copper Alloy Die Forgings (Hot-Pressed).
.4 ASTM B505/B505M-11, Standard Specification for Copper-Base Alloy Continuous Castings.

.3 Manufacturers Standardization Society of the Valve and Fittings Industry, Inc. (MSS)
.1 MSS SP-25-2008, Standard Marking System for Valves, Fittings, Flanges and Unions.
.2 MSS SP-80-2008, Bronze Gate Globe, Angle and Check Valves.
.3 MSS SP-110-2010, Ball Valves, Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00.

.2 Product Data:
.1 Provide manufacturer's printed product literature and data sheets for equipment and systems and include product characteristics, performance criteria, physical size, finish and limitations.
.2 Submit WHMIS MSDS - Material Safety Data Sheets.

1.3 CLOSEOUT SUBMITTALS

.1 Provide maintenance data for incorporation into manual specif Section 01 78 00.

1.4 DELIVERY, STORAGE AND HANDLING

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

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

.3 Refer to Section 01 74 20.

PART 2 - PRODUCTS

2.1 MATERIALS

.1 Valves:
.1 Except for specialty valves, to be single manufacturer.
.2 Products to have CRN registration numbers.

.2 End Connections:
.1 Connection into adjacent piping/tubing:
.1 Steel pipe systems: screwed ends to ANSI/ASME B1.20.1.
.2 Copper tube systems: solder ends grooved ends to ASME B16.18.

.3 Gate Valves:
.1 Requirements common to gate valves, unless specified otherwise:
.1 Standard specification: MSS SP-80.
.2 Bonnet: union with hexagonal shoulders.
.3 Connections: screwed with hexagonal shoulders.
.4 Inspection and pressure testing: to MSS SP-80. Tests to be hydrostatic.
.5 Packing: non-asbestos.
.6 Handwheel: non-ferrous.
.7 Handwheel Nut: bronze to ASTM B62.
.2 NPS 2 and under, non-rising stem, solid wedge disc, Class 12.5
.1 Body: with long disc guides, screwed bonnet with stem retaining nut.
.2 Operator: Handwheel.
.3 NPS 2 and under, non-rising stem, solid wedge disc, Class 150:
.1 Body: with long disc guides, screwed bonnet with stem retaining nut.
.2 Operator: handwheel.

2.1 MATERIALS (Cont'd)

.3 Gate Valves:(Cont'd)

.4 NPS 2 and under, rising stem, split wedge disc, Class 125:

.1 Body: with long disc guides, screwed bonnet.

.2 Disc: split wedge, bronze to ASTM B283/B283M, loosely secured to stem.

.3 Operator: handwheel lockshield.

.5 NPS 2 and under, rising stem, solid wedge disc, Class 125:

.1 Body: with long disc guides, screwed bonnet.

.2 Operator: handwheel.

.6 NPS 2 and under, rising stem, solid wedge disc, Class 150:

.1 Body: with long disc guides, screwed union bonnet.

.2 Operator: handwheel.

.4 Globe Valves:

.1 Requirements common to globe valves, unless specified otherwise:

.1 Standard specification: MSS SP-80.

.2 Bonnet: union with hexagonal shoulders.

.3 Connections: screwed with hexagonal shoulders.

.4 Pressure testing: to MSS SP-80. Tests to be hydrostatic.

.5 Stuffing box: threaded to bonnet with gland follower, packing nut, high grade non-asbestos packing.

.6 Handwheel: non-ferrous.

.7 Handwheel Nut: bronze to ASTM B62.

.2 NPS 2 and under, composition disc, Class 125:

.1 Body and bonnet: screwed bonnet.

.2 Disc and seat: renewable rotating PTFE disccomposition to suit service conditions, regrindable bronze seat, loosely secured to bronze stem to ASTM B505/B505M.

.3 Operator: handwheel lockshield.

.3 NPS 2 and under, composition disc, Class 150:

.1 Body and bonnet: union bonnet.

.2 Disc and seat: renewable rotating PTFE disc in easily removable disc holder, regrindable bronze seat, loosely secured to bronze stem to ASTM B505/B505M.

.3 Operator: handwheel lockshield.

2.1 MATERIALS (Cont'd)

.4 Globe Valves:(Cont'd)

.4 NPS 2 and under, plug disc, Class 150, screwed ends:

.1 Body and bonnet: union bonnet.

.2 Disc and seat ring: tapered plug type with disc stem ring of AISI S420 stainless steel to ASTM A276, loosely secured to stem.

.3 Operator: handwheel.

.5 Angle valve, NPS 2 and under, composition disc, Class 150:

.1 Body and bonnet: union bonnet.

.2 Disc and seat: renewable rotating PTFE disc in slip-on easily removable disc holder having integral guides, regrindable bronze seat, loosely secured to stem.

.3 Operator: handwheel lockshield.

.5 Check Valves:

.1 Requirements common to check valves, unless specified otherwise:

.1 Standard specification: MSS SP-80.

.2 Connections: screwed with hexagonal shoulders.

.2 NPS 2 and under, swing type, bronze disc, Class 125:

.1 Body: Y-pattern with integral seat at 45 degrees, screw-in cap with hex head.

.2 Disc and seat: renewable rotating disc, two-piece hinge disc construction; seat: regrindable.

.3 NPS 2 and under, swing type, bronze disc:

.1 Body: Y-pattern with integral seat at 45 degrees, screw-in cap with hex head.

.2 Disc and seat: renewable rotating disc, two-piece hinge disc construction; seat: regrindable.

.4 NPS 2 and under, swing type, composition disc, Class 200:

.1 Body: Y-pattern with integral seat at 45 degrees, screw-in cap with hex head.

.2 Disc: renewable rotating disc of number 6 composition to suit service conditions, bronze two-piece hinge disc construction.

.5 NPS 2 and under, horizontal lift type, composition disc, Class 150:

.1 Body: with integral seat, union bonnet ring with hex shoulders, cap.

.2 Disc: renewable PTFE no. 6 composition rotating disc in disc holder having guides top and bottom, of bronze to ASTM B62.

2.1 MATERIALS (Cont'd)

.5 Check Valves:(Cont'd)

.6 NPS 2 and under, vertical lift type, bronze disc, Class 125:

.1 Disc: rotating disc having guides top and bottom, disc guides, retaining rings.

.6 Silent Check Valves:

.1 NPS 2 and under:

.1 Body: cast high tensile bronze to ASTM B62 with integral seat.

.2 Pressure rating: Class 125.

.3 Connections: screwed ends to ANSI/ASME B1.20.1 and with hex. shoulders.

.4 Disc and seat: renewable rotating disc.

.5 Stainless steel spring, heavy duty.

.6 Seat: regrindable.

.7 Ball Valves:

.1 NPS 2 and under:

.1 Body and cap: cast high tensile bronze to ASTM B62.

.2 Pressure rating: Class125 2760-kPa CWP 4140-kPa CWP, 860 kPa steam.

.3 Connections: screwed ends to ASME B1.20.1 and with hexagonal shoulders solder ends to ANSI.

.4 Stem: tamperproof ball drive.

.5 Stem packing nut: external to body.

.6 Ball and seat: replaceable stainless steel hard chrome solid ball and Teflon seats.

.7 Stem seal: TFE with external packing nut.

.8 Operator: removable lever handle.

.8 Butterfly Valves:

.1 NPS 2 1/2 through NPS 6, 2068 kPa with grooved ends.

.1 Body: cast bronze, with copper-tube dimensioned grooved ends.

.2 Disc: elastomer coated ductile iron with integrally cast stem.

.3 Operator: lever or handwheel.

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Install rising stem valves in upright position with stem above horizontal.

.2 Remove internal parts before soldering.

.3 Install valves with unions at each piece of equipment arranged to allow servicing, maintenance, and equipment removal.

3.2 CLEANING

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

END

PART 1 - GENERAL

1.1 SUMMARY

.1 Section Includes:
.1 Valves, gate, globe, and check.

.2 Sustainable requirements for construction and verification.

.3 Related Sections:
.1 Section 01 47 15 - Sustainable Requirements: Construction.
.2 Section 01 47 17 - Sustainable Requirements: Contractor's Verification.
.3 Section 01 35 29.06 - Health and Safety Requirements.
.4 Section 23 05 01 - Installation of Pipework.

1.2 REFERENCES

.1 American National Standards Institute (ANSI)/American Society of Mechanical Engineers (ASME).
.1 ANSI/ASME B16.1-2005, Cast Iron Pipe Flanges and Flanged Fittings.

.2 American Society for Testing and Materials International (ASTM).
.1 ASTM A49-01(2006) , Specification for Heat-Treated Carbon Steel Joint Bars.
.2 ASTM A126-04, Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings.
.3 ASTM B61-08, Specification for Steam or Valve Bronze Castings.
.4 ASTM B62-09, Specification for Composition Bronze or Ounce Metal Castings.
.5 ASTM B85/B85M-09, Specification for Aluminum-Alloy Die Castings.
.6 ASTM B209-10, Specification for Aluminum and Aluminum-Alloy Sheet and Plate.

.3 Manufacturers Standardization Society of the Valve and Fittings Industry, Inc. (MSS).
.1 MSS SP-70-2006, Gray Iron Gate Valves, Flanged and Threaded Ends.
.2 MSS SP-71-2005, Gray Iron Swing Check Valves, Flanged and Threaded Ends.
.3 MSS SP-82-1992, Valve Pressure Testing Methods.
.4 MSS SP-85-2002, Cast Iron Globe and Angle Valves, Flanged and Threaded Ends.

1.2 REFERENCES (Cont'd)

.4 American Petroleum Institute (API).
.1 API 598-2009, Valve Inspection and Testing.

1.3 SUBMITTALS

.1 Submittals in accordance with Section 01 33 00.

.2 Product Data: submit WHMIS MSDS - Material Safety Data Sheets.
.1 Submit shop drawings and product data in accordance with Section 01 33 00.
.2 Submit data for valves specified in this section.

.3 Closeout Submittals:
.1 Submit maintenance data for incorporation into manual specified in Section 01 78 00.

1.4 QUALITY ASSURANCE

.1 Health and Safety:
.1 Do construction occupational health and safety in accordance with Section 01 35 29.06.

1.5 DELIVERY STORAGE AND DISPOSAL

.1 Refer to Section 01 74 20.

1.6 MAINTENANCE

.1 Extra Materials:

PART 2 - PRODUCTS

2.1 MATERIAL

.1 Valves:
.1 Except for specialty valves, to be of single manufacturer.

.2 Standard specifications:
.1 Gate valves: MSS SP-70.
.2 Globe valves: MSS SP-85.
.3 Check valves: MSS SP-71.

.3 Requirements common to valves, unless specified otherwise:
.1 Body, bonnet: cast iron to ASTM B209 Class B.

2.1 MATERIAL (Cont'd)

.3 (Cont'd)

.2 Connections: flanged ends plain face with 2 mm raised face with serrated finish to ANSI B16.1.

.3 Inspection and pressure testing: to MSS SP-82.

.4 Bonnet gasket: non-asbestos.

.5 Stem: to have precision-machined Acme or 60 degrees V threads, top screwed for handwheel nut.

.6 Stuffing box: non-galling two-piece ball-jointed packing gland, gland bolts and nuts.

.7 Gland packing: non-asbestos.

.8 Handwheel: Die-cast aluminum alloy to ASTM B85 or malleable iron to ASTM A49. Nut of bronze to ASTM B62.

.9 Identification tag: with catalogue number, size, other pertinent data.

.4 All products to have CRN registration numbers.

2.2 GATE VALVES

.1 NPS 2 1/2 - 8, non rising stem, inside screw, bronze iron trim, solid wedge disc:

.1 Body and multiple-bolted bonnet: with bosses in body and bonnet for taps and drains, full length disc guides designed to ensure correct re-assembly. Class 125.

.2 Disc: solid offset taper wedge, bronze to ASTM B62.

.3 Seat rings: renewable bronze to ASTM B62, screwed into body.

.4 Stem: bronze to ASTM B62.

.5 Disc: solid offset taper wedge, cast iron to ASTM A126 Class B, secured to wrought steel stem.

.6 Seat: Integral with body.

.7 Stem: wrought steel.

.8 Operator: Handwheel.

.9 Bypass: complete with union and NPS gate globe valve as Section 23 05 23.01.

.2 NPS 2 1/2-8, outside screw and yoke (OS&Y), bronze iron trim, solid wedge disc:

.1 Body and multiple-bolted bonnet: with bosses in body and bonnet for taps and drains, full length disc guides designed to ensure correct re-assembly, yoke, yoke hub, yoke sleeve and nut. Class 125.

.2 Disc: solid offset taper wedge, bronze to ASTM B62 up to NPS 3, cast iron with bronze disc

2.2 GATE VALVES (Cont'd) .2 (Cont'd)

.2 Disc:(Cont'd)
rings on other sizes, secured to stem through integral forged T-head disc-stem connection.
.3 Seat rings: renewable bronze screwed into body.
.4 Stem: nickel-plated steel manganese-bronze.
.5 Disc: solid offset taper all-cast iron, secured to stem through integral forged T-head disc-stem connection.
.6 Seat rings: integral with body.
.7 Stem: nickel-plated steel.
.8 Pressure-lubricated operating mechanism.
.9 Operator: Handwheel.
.10 Bypass: complete with union and NPS gate globe valve.

2.3 UNDERWRITERS APPROVED GATE VALVE .1 NPS 2 1/2 - 14, OS&Y:

.1 Approvals: UL and FM approved for fire service.
.2 UL and FM Label: on valve yoke.
.3 Body, Bonnet: cast iron to ASTM A126 Class B. Wall thicknesses to ANSI B16.1 and ULC 262 (B).
.4 Bonnet bushing, yoke sleeve: bronze, to FM requirements.
.5 Packing gland: bronze.
.6 Stem: manganese bronze. Diameter to ULC C-262 (B).
.7 Stuffing box dimensions, gland bolt diameter: to ULC C-262 (B).
.8 Bosses for bypass valve, drain: on NPS 4 and over.
.9 Disc: solid taper wedge. Up to NPS 3: bronze. NPS 4 and over: cast iron with bronze disc rings.
.10 Disc seat ring: self-aligning, Milwood undercut on NPS 3 - 12.
.11 Pressure rating:
 .1 NPS 2-1/2 - 12: 1.7 Mpa CWP.
 .2 NPS 14-1.2: 1.2 MPa CWP.
.12 Operator: handwheel.
.13 Bypass: complete with union and NPS gate globe valve as Section 23 05 23.01, paragraph.

2.4 GLOBE VALVES .1 NPS 2 1/2 - 10, OSY:

.1 Body: with multiple-bolted bonnet.
.2 WP: 860 kPa steam, 1.4 MPa CWP.
.3 Bonnet-yoke gasket: non-asbestos.

2.4 GLOBE VALVES (Cont'd)

.1 (Cont'd)
.4 Disc: bronze to ASTM B62, fully guided from bottom, securely yet freely connected to stem for swivel action and accurate engagement with disc.
.5 Seat ring: renewable, regrindable, screwed into body.
.6 Stem: bronze to ASTM B62.
.7 Operator: Handwheel.
.8 Bypass: complete with union and NPS gate globe valve.

2.5 BYPASSES FOR GATE AND GLOBE VALVES

.1 Locations: on valves as indicated.

.2 Position of bypass valve on main valves.

.3 Size of bypass valve:
.1 Main valve up to NPS 8: NPS 3/4.
.2 Main valve NPS 10 and over: NPS 1.

.4 Type of bypass valves:
.1 On gate valve: globe, with composition bronze disc, bronze trim, to Section 23 05 23.01. Pressure rating to match main valve.
.2 On globe valve: globe, with composition bronze disc, bronze trim, to Section 23 05 23.01. Pressure rating to match main valve.

2.6 VALVE OPERATORS

.1 Install valve operators as follows:
.1 Handwheel: on valves except as specified.
.2 Handwheel with chain operators: on valves installed more than 2400 mm above floor in boiler rooms and mechanical equipment rooms.

2.7 CHECK VALVES

.1 Swing check valves, Class 125:
.1 Body and bolted cover: with tapped and plugged opening on each side for hinge pin. Flanged ends: plain faced with smooth finish.
.1 Up to NPS 16: cast iron to ASTM A126 Class B.
.2 NPS 18 and over: cast iron to ASTM A126 Class C.
.2 Ratings:
.1 NPS 2 1/2 - 12: 860 kPa steam; 1.4 MPa CWP.

2.7 CHECK VALVES (Cont'd)

.1 (Cont'd)
.2 Ratings:(Cont'd)
.2 NPS 14 - 16: 860 kPa steam; 1.03 MPa CWP.
.3 NPS 18 and over: 1.03 MPa CWP.
.3 Disc: rotating for extended life.
.1 Up to NPS 6: bronze to ASTM B62.
.2 NPS 8 and over: bronze-faced cast iron.
.4 Seat rings: renewable bronze to ASTM B62 screwed into body.
.5 Hinge pin, bushings: renewable bronze to ASTM B62.
.6 Disc: ASTM A126 Class B, secured to stem, rotating for extended life.
.7 Seat: cast iron, integral with body.
.8 Hinge pin: exelloy; bushings: malleable iron.
.9 Identification tag: fastened to cover.
.10 Hinge: galvanized malleable iron.

.2 Swing check valves, NPS 2 1/2 - 8 Class 250:
.1 Body and bolted cover: cast iron to ASTM A126 Class B with tapped and plugged opening on each side for hinge pin.
.2 Flanged ends: 2 mm raised face with serrated finish.
.3 Rating: 250 psi steam; 500 psi CWP.
.4 Disc: rotating for extended life.
.1 Up to NPS 3: bronze to ASTM B61.
.5 Seat rings: renewable bronze to ASTM B61, screwed into body.
.6 Hinge pin, bushings: renewable, bronze to ASTM B61.
.7 Hinge: galvanized malleable iron.
.8 Identification tag: fastened to cover.

2.8 SILENT CHECK VALVES

.1 Construction:
.1 Body: malleable or ductile iron with integral seat.
.2 Pressure rating: class 125, WP = 860 kPa.
.3 Connections: grooved ends.
.4 Disc: bronze or stainless steel renewable rotating disc.
.5 Seat: renewable, EPDM.
.6 Stainless steel spring, heavy duty.

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Install rising stem valves in upright position with stem above horizontal.

END

PART 1 - GENERAL

1.1 REFERENCES

.1 American National Standards Institute (ANSI)/American Society of Mechanical Engineers (ASME).
.1 ANSI/ASME B1.20.1-1983(R2001), Pipe Threads, General Purpose (Inch).
.2 ANSI/ASME B16.1-2005, Cast Iron Pipe Flanges and Flanged Fittings.
.3 ANSI/ASME B16.5-2009, Pipe Flanges and Flanged Fittings.
.4 ANSI/ASME B16.11-2009, Forged Fittings, Socket-Welding and Threaded.
.5 ANSI/ASME B16.25-2007, Buttwelding Ends.
.6 ANSI/ASME B16.34-2009 and 2009 supplement, Valves - Flanged, Threaded and Welding Ends.

.2 American National Standards Institute (ANSI)/American Petroleum Institute (API).
.1 ANSI/API 609-2009, Lug- and Water-Type Butterfly Valves.

.3 American Society for Testing and Materials International, (ASTM).
.1 ASTM A126-04, Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings.
.2 ASTM B62-09, Specification for Composition Bronze or Ounce Metal Castings.
.3 ASTM B209M-10, Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric).

.4 Manufacturers Standardization Society of the Valve and Fittings Industry, Inc. (MSS).
.1 MSS SP-67-2002a, Butterfly Valves.

1.2 SUBMITTALS

.1 Submittals in accordance with Section 01 33 00.

.2 Product Data: submit WHMIS MSDS - Material Safety Data Sheets.
.1 Submit shop drawings and product data in accordance with Section 01 33 00.
.2 Submit product data in accordance with Section 01 33 00.
.3 Submit data for valves specified this section.

.3 Closeout Submittals:
.1 Submit maintenance data for incorporation into manual specified in Section 01 78 00.

1.3 QUALITY ASSURANCE

.1 Health and Safety:
.1 Do construction occupational health and safety in accordance with Section 01 35 29.06.

1.4 DELIVERY STORAGE AND DISPOSAL

.1 Refer to Section 01 74 20.

PART 2 - PRODUCTS

2.1 BUTTERFLY VALVES - RESILIENT SEAT - 200 PSIG

.1 Except to specialty valves, to be of single manufacturer.

.2 To be suitable for dead-end service.

.3 CRN registration number required for products.

.4 Sizes: Wafer Lug type: NPS 2 to 30.

.5 Pressure rating for tight shut-off at temperatures up to maximum for seat material.
.1 NPS 2 - 12: 200 psig.

.6 Minimum seat temperature ratings to 135°C.

.7 Application: on-off operation.

.8 Full lug body (threaded).

.9 Operators:
.1 NPS 2 - 6: Handles capable of locking in any of ten (10) positions - 0 degrees to 90 degrees. Handle and release trigger - ductile iron. Return spring and hinge pin: carbon steel. Latch plate and mounting hardware: cadmium plated carbon steel.
Standard coating: black laquer.

.10 Designed to comply with MSS SP-67 and API 609.

.11 Compatible with ANSI Class 125/Class 150 flanges.

.12 Construction:
.1 Body ductile iron ss aluminum bronze.
.2 Disc: aluminum bronze 316 SS.
.3 Seat: EPDM Buna-N Viton EPT.
.4 Shaft: 316 416 stainless steel.
.5 Taper pin: 316 SS Monel.

2.1 BUTTERFLY VALVES - RESILIENT SEAT - 200 PSIG (Cont'd)

.12 Construction:(Cont'd)
.6 Key: carbon steel stainless.
.7 O-Ring: Buna-N.
.8 Bushings: Luberized bronze Teflon.

2.2 BUTTERFLY VALVES - RESILIENT SEAT - 285 PSIG

.1 Sizes: Lug type: NPS 2 to 48.

.2 Pressure rating: 285 psig at 135°C.

.3 Lug body: 150 ANSI bolt pattern.

.4 Full lug body (threaded).

.5 Application: for on-off service.

.6 Operators:
.1 NPS 2 - 6: Handles capable of locking in any of ten (10) positions - 0 degrees to 90 degrees. Handle and release trigger - ductile iron. Return spring and hinge pin: carbon steel. Latch plate and mounting hardware: cadmium plated carbon steel.
.2 Install parallel or perpendicular to pipeline.

.7 Designed to comply with MSS SP-67 and API 609.

.8 Compatible with ANSI B16.1 Class 125 (iron) and ANSI B16.5 Class 150 (steel) flanges.

.9 Construction:
.1 Body: ductile iron.
.2 Disc: aluminum bronze 316 SS.
.3 Seat: EPDM Buna-N Viton EPT.
.4 Refer to manufacturer's literature for additional materials.
.5 Shaft: NPS 2 - 12: 416 stainless steel NPS 14 - 48, 316 stainless steel.
.6 Taper pin: 316 SS Monel.
.7 Blowout proof stem.
.8 O-Ring: Buna-N.
.9 Bushings: teflon.
.10 Disc shall not be pinned to shaft.
.11 Bubble tight shutoff with downstream flanges removed, class 6 shutoff.

2.3 MOUNTING FLANGES

.1 Class 125 cast iron to ANSI B16.1 or Class 150 steel to B16.5 pipe flanges.

2.4 PNEUMATIC ACTUATORS

.1 Operation: rack and pinion to provide linear torque-stroke proportion in compact package.
.1 Select torque to suit application. Refer to manufacturer's data sheets.
.2 Housing and end caps: hard anodized aluminum, complete with guide and Delrin wear pads for long service life.
.3 Actuators internally lubricated to ensure long service life.

2.5 ELECTRIC ACTUATORS

.1 Refer to Division 25.

PART 3 - EXECUTION

3.1 PREPARATION

.1 Valve and mating flange preparation.
.1 Inspect adjacent pipeline, remove rust, scale, welding slag, other foreign material.
.2 Ensure that valve seats and pipe flange faces are free of dirt or surface irregularities which may disrupt flange seating and cause external leakage.
.3 Install butterfly valves with disc in almost closed position.
.4 Inspect valve disc seating surfaces and waterway and eliminate dirt or foreign material.

3.2 INSTALLATION OF VALVES

.1 Install in accordance with manufacturer's instructions.

.2 Do not use gaskets between pipe flanges and valves unless instructed otherwise by valve manufacturer.

.3 Verify suitability of valve for application by inspection of identification tag.

.4 Mount actuator on to valve prior to installation.

.5 Handle valve with care so as to prevent damage to disc and seat faces.

3.2 INSTALLATION OF VALVES (Cont'd)

.6 Valves in horizontal pipe lines should be installed with stem in horizontal position to minimize liner and seal wear.

.7 Ensure that valves are centered between bolts before bolts are tightened and then opened and closed to ensure unobstructed disc movement. If interference occurs due, for example to pipe wall thickness, taper bore adjacent piping to remove interference.

END

PART 1 - GENERAL

1.1 REFERENCES

.1 ASTM International
.1 ASTM A125-96(2007), Standard Specification for Steel Springs, Helical, Heat-Treated.
.2 ASTM A307-10, Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
.3 ASTM A563-07a, Standard Specification for Carbon and Alloy Steel Nuts.

.2 Factory Mutual (FM)

.3 Manufacturer's Standardization Society of the Valves and Fittings Industry (MSS)
.1 MSS SP 58-2009, Pipe Hangers and Supports - Materials, Design and Manufacture.
.2 MSS SP 69-2003, Pipe Hangers and Supports - Selection and Application.
.3 MSS SP 89-2003, Pipe Hangers and Supports - Fabrication and Installation Practices.

.4 Underwriter's Laboratories of Canada (ULC)
.1 CAN/ULC-

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00.

.2 Product Data:
.1 Provide manufacturer's printed product literature and data sheets for hangers and supports and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Shop Drawings:
.1 Submit shop drawings for:
.1 Bases, hangers and supports.
.2 Connections to equipment and structure.
.3 Structural assemblies.

.4 Manufacturers' Instructions:
.1 Provide manufacturer's installation instructions.
.1 Departmental Representative will make available 1 copy of systems supplier's installation instructions.

1.3 CLOSEOUT SUBMITTALS

.1 Provide maintenance data for incorporation into manual specified in Section 01 78 00.

1.4 DELIVERY, STORAGE AND HANDLING

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

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

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

.1 Design Requirements:
.1 Construct pipe hanger and support to manufacturer's recommendations utilizing manufacturer's regular production components, parts and assemblies.
.2 Base maximum load ratings on allowable stresses prescribed by ASME B31.1 or MSS SP 58.
.3 Ensure that supports, guides, anchors do not transmit excessive quantities of heat to building structure.

2.2 GENERAL

.1 Fabricate hangers, supports and sway braces in accordance with MSS SP 58 and ASME B31.1.

.2 Use components for intended design purpose only. Do not use for rigging or erection purposes.

2.3 PIPE HANGERS

.1 Finishes:
.1 Pipe hangers and supports: galvanized painted with zinc-rich paint after manufacture.
.2 Use electro-plating galvanizing processhot dipped galvanizing process.
.3 Ensure steel hangers in contact with copper piping are copper plated epoxy coated.

.2 Upper attachment structural: suspension from lower flange of I-Beam:

2.3 PIPE HANGERS (Cont'd)

.2 Upper attachment structural:(Cont'd)
.1 Cold piping NPS 2 maximum: malleable iron C-clamp with hardened steel cup point setscrew, locknut and carbon steel retaining clip.
.1 Rod: 9 mm UL listed 13 mm FM approved.
.2 Cold piping NPS 2 1/2 or greater, hot piping: malleable iron beam clamp, eye rod, jaws and extension with carbon steel retaining clip, tie rod, nuts and washers, UL listed FM approved to MSS-SP 58 and MSS-SP 69.

.3 Upper attachment structural: suspension from upper flange of I-Beam:
.1 Cold piping NPS 2 maximum: ductile iron top-of-beam C-clamp with hardened steel cup point setscrew, locknut and carbon steel retaining clip, UL listed FM approved to MSS SP 69.
.2 Cold piping NPS 2 1/2 or greater, hot piping: malleable iron top-of-beam jaw-clamp with hooked rod, spring washer, plain washer and nut UL listed FM approved.

.4 Upper attachment to concrete:
.1 Ceiling: carbon steel welded eye rod, clevis plate, clevis pin and cotters with weldless forged steel eye nut. Ensure eye 6 mm minimum greater than rod diameter.
.2 Concrete inserts: wedge shaped body with knockout protector plateUL listed FM approved to MSS SP 69.

.5 Shop and field-fabricated assemblies:
.1 Trapeze hanger assemblies:.
.2 Steel brackets:.
.3 Sway braces for seismic restraint systems: to Section.

.6 Hanger rods: threaded rod material to MSS SP 58:
.1 Ensure that hanger rods are subject to tensile loading only.
.2 Provide linkages where lateral or axial movement of pipework is anticipated.
.3 Do not use 22 mm or 28 mm rod.

.7 Pipe attachments: material to MSS SP 58:
.1 Attachments for steel piping: carbon steel black galvanized.
.2 Attachments for copper piping: copper plated black steel.
.3 Use insulation shields for hot pipework.
.4 Oversize pipe hangers and supports.

2.3 PIPE HANGERS (Cont'd)

.8 Adjustable clevis: material to MSS SP 69 UL listed FM approved, clevis bolt with nipple spacer and vertical adjustment nuts above and below clevis.
.1 Ensure "U" has hole in bottom for rivetting to insulation shields.

.9 Yoke style pipe roll: carbon steel yoke, rod and nuts with cast iron roll, to MSS SP 69.

.10 U-bolts: carbon steel to MSS SP 69 with 2 nuts at each end to ASTM A563.
.1 Finishes for steel pipework: black galvanized.
.2 Finishes for copper, glass, brass or aluminum pipework: black galvanized, with formed portion plastic coated epoxy coated.

.11 Pipe rollers: cast iron roll and roll stand with carbon steel rod to MSS SP 69.

2.4 RISER CLAMPS

.1 Steel or cast iron pipe: galvanized black carbon steel to MSS SP 58, type 42, UL listed FM approved.

.2 Copper pipe: carbon steel copper plated to MSS SP 58, type 42.

.3 Bolts: to ASTM A307.

.4 Nuts: to ASTM A563.

2.5 INSULATION PROTECTION SHIELDS

.1 Insulated cold piping:
.1 64 kg/m^3 density insulation plus insulation protection shield to: MSS SP 69, galvanized sheet carbon steel. Length designed for maximum 3 m span.

.2 Insulated hot piping:
.1 Curved plate 300 mm long, with edges turned up, welded-in centre plate for pipe sizes NPS 12 and over, carbon steel to comply with MSS SP 69.

2.6 CONSTANT SUPPORT SPRING HANGERS

.1 Springs: alloy steel to ASTM A125, shot peened, magnetic particle inspected, with +/-5% spring rate tolerance, tested for free height, spring rate, loaded height and provided with Certified Mill Test Report (CMTR).

.2 Load adjustability: 10% minimum adjustability each side of calibrated load. Adjustment without special tools. Adjustments not to affect travel capabilities.

.3 Provide upper and lower factory set travel stops.

.4 Provide load adjustment scale for field adjustments.

.5 Total travel to be actual travel + 20%. Difference between total travel and actual travel 25 mm minimum.

.6 Individually calibrated scales on each side of support calibrated prior to shipment, complete with calibration record.

2.7 VARIABLE SUPPORT SPRING HANGERS

.1 Vertical movement: 13 mm minimum, 50 mm maximum, use single spring pre-compressed variable spring hangers.

.2 Vertical movement greater than 50 mm: use double spring pre-compressed variable spring hanger with 2 springs in series in single casing.

.3 Variable spring hanger complete with factory calibrated travel stops. Provide certificate of calibration for each hanger.

.4 Steel alloy springs: to ASTM A125, shot peened, magnetic particle inspected, with +/-5 % spring rate tolerance, tested for free height, spring rate, loaded height and provided with CMTR.

2.8 EQUIPMENT SUPPORTS

.1 Fabricate equipment supports not provided by equipment manufacturer from structural grade steel. Submit calculations with shop drawings.

2.9 EQUIPMENT ANCHOR BOLTS AND TEMPLATES

.1 Provide templates to ensure accurate location of anchor bolts.

2.10 HOUSE-KEEPING PADS

.1 Extend, reconfigure and extend existing concrete pad to suit new air handler.

PART 3 - EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 INSTALLATION

.1 Install in accordance with:
.1 Manufacturer's instructions and recommendations.

.2 Clamps on riser piping:
.1 Support independent of connected horizontal pipework using riser clamps and riser clamp lugs welded to riser.
.2 Bolt-tightening torques to industry standards.
.3 Steel pipes: install below coupling or shear lugs welded to pipe.
.4 Cast iron pipes: install below joint.

.3 Clevis plates:
.1 Attach to concrete with 4 minimum concrete inserts, one at each corner.

.4 Provide supplementary structural steelwork where structural bearings do not exist or where concrete inserts are not in correct locations.

3.3 HANGER SPACING

.1 Plumbing piping: to Canadian Plumbing Code Provincial Code authority having jurisdiction.

.2 Fire protection: to applicable fire code.

.3 Copper piping: up to NPS 1/2: every 1.5 m.

3.3 HANGER SPACING (Cont'd)

.4 Flexible joint roll groove pipe: in accordance with table below for steel, but not less than one hanger at joints. Table listings for straight runs without concentrated loads and where full linear movement is not required.

.5 Within 300 mm of each elbow.

Maximum Pipe Size : NPS	Maximum Spacing Steel	Maximum Spacing Copper
up to 1-1/4	2.4 m	1.8 m
1-1/2	3.0 m	2.4 m
2	3.0 m	2.4 m
2-1/2	3.7 m	3.0 m
3	3.7 m	3.0 m
3-1/2	3.7 m	3.3 m
4	3.7 m	3.6 m

3.4 HANGER INSTALLATION

.1 Install hanger so that rod is vertical under operating conditions.

.2 Adjust hangers to equalize load.

.3 Support from structural members. Where structural bearing does not exist or inserts are not in suitable locations, provide supplementary structural steel members.

3.5 HORIZONTAL MOVEMENT

.1 Angularity of rod hanger resulting from horizontal movement of pipework from cold to hot position not to exceed 4 degrees from vertical.

.2 Where horizontal pipe movement is less than 13 mm, offset pipe hanger and support so that rod hanger is vertical in the hot position.

3.6 FINAL ADJUSTMENT

.1 Adjust hangers and supports:

.1 Ensure that rod is vertical under operating conditions.
.2 Equalize loads.

.2 Adjustable clevis:
.1 Tighten hanger load nut securely to ensure proper hanger performance.
.2 Tighten upper nut after adjustment.

3.6 FINAL ADJUSTMENT (Cont'd)

.3 C-clamps:
.1 Follow manufacturer's recommended written instructions and torque values when tightening C-clamps to bottom flange of beam.

.4 Beam clamps:
.1 Hammer jaw firmly against underside of beam.

3.7 FIELD QUALITY CONTROL

.1 Site Tests: conduct following tests in accordance with Section 01 45 00 and submit report as described in PART 1 - ACTION AND INFORMATIONAL SUBMITTALS.

.2 Manufacturer's Field Services:
.1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Field Reports as described in PART 1 - ACTION AND INFORMATIONAL SUBMITTALS.
.2 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.
.3 Schedule site visits, to review Work, as directed in PART 1 - QUALITY ASSURANCE.

END

PART 1 - GENERAL

1.1 RELATED SECTIONS

.1 Section 23 05 93 - Testing, Adjusting and Balancing of HVAC.

1.2 REFERENCES

.1 National Fire Protection Association (NFPA)
.1 NFPA 13-2009, Installation of Sprinkler Systems.

.2 National Building Code of Canada (NBC) 2010.

1.3 SHOP DRAWINGS

.1 Submit shop drawings in accordance with Section 01 33 00.

.2 Provide separate shop drawings for each isolated system system shop drawings complete with performance and product data.

1.4 WASTE MANAGEMENT AND DISPOSAL

.1 Refer to Section 01 74 20.

PART 2 - PRODUCTS

2.1 GENERAL

.1 Size and shape of bases type and performance of vibration isolation to be as indicated.

2.2 ELASTOMERIC PADS

.1 Type EP1 - neoprene waffle or ribbed; 9mm minimum thick; 50 durometer; maximum loading 350 kPa.

.2 Type EP2 - rubber waffle or ribbed; 9 mm minimum thick; 30 durometer natural rubber; maximum loading 415 kPa.

.3 Type EP3 - neoprene-steel-neoprene; 9 mm minimum thick neoprene bonded to 1.71 mm steel plate; 50 durometer neoprene, waffle or ribbed; holes sleeved with isolation washers; maximum loading 350 kPa.

2.2 ELASTOMERIC PADS (Cont'd)

.4 Type EP4 - rubber-steel-rubber; 9 mm minimum thick rubber bonded to 1.71 mm steel plate; 30 durometer natural rubber, waffle or ribbed; holes sleeved with isolation washers; maximum loading 415 kPa.

2.3 ELASTOMERIC MOUNTS

.1 Type M1 - colour coded; neoprene in shear; maximum durometer of 60; threaded insert and two bolt-down holes; ribbed top and bottom surfaces.

2.4 SPRINGS

.1 Design stable springs so that ratio of lateral to axial stiffness is equal to or greater than 1.2 times the ratio of static deflection to working height. Select for 50% travel beyond rated load. Units to be complete with levelling devices.

.2 Ratio of height when loaded to diameter of spring to be between 0.8 to 1.0.

.3 Cadmium plate for outdoor 100% relative humidity all installations.

.4 Colour code springs.

2.5 SPRING MOUNT

.1 Zinc or cadmium plated hardware; housings coated with rust resistant paint.

.2 Type M2 - stable open spring: support on bonded 6 mm minimum thick ribbed neoprene or rubber friction and acoustic pad.

.3 Type M3 - stable open spring: 6 mm minimum thick ribbed neoprene or rubber friction and acoustic pad, bonded under isolator and on isolator top plate; levelling bolt for rigidly mounting to equipment.

.4 Type M4 - restrained stable open spring: supported on bonded 6 mm minimum thick ribbed neoprene or rubber friction and acoustic pad; built-in resilient limit stops, removable spacer plates.

.5 Type M5 - enclosed spring mounts with snubbers for isolation up to 950 kg maximum.

.6 Performance: as indicated.

2.6 HANGERS

.1 Colour coded springs, rust resistant, painted box type hangers. Arrange to permit hanger box or rod to move through a 30° arc without metal to metal contact.

.2 Type H1 - neoprene - in-shear, moulded with rod isolation bushing which passes through hanger box.

.3 Type H2 - stable spring, elastomeric washer, cup with moulded isolation bushing which passes through hanger box.

.4 Type H3 - stable spring, elastomeric element, cup with moulded isolation bushing which passes through hanger box.

.5 Type H4 - stable spring, elastomeric element with precompression washer and nut with deflection indicator.

.6 Performance: as indicated.

2.7 STRUCTURAL BASES

.1 Type B1 - Prefabricated steel base: integrally welded on sizes up to 2400 mm on smallest dimension, split for field welding on sizes over 2400 mm on smallest dimension and reinforced for alignment of drive and driven equipment; without supplementary hold down devices; complete with isolation element attached to base brackets arranged to minimize height; pre-drilled holes to receive equipment anchor bolts; and complete with adjustable built-in motor slide rail where indicated.

.2 Type B2 - Steel rail base: structural steel, positioned for alignment of drive and driven equipment; without supplementary hold down devices; complete with isolation element attached to base brackets arranged to minimize height; and pre-drilled holes to receive equipment anchor bolts.

.3 Bases to clear housekeeping pads by 25 mm minimum.

2.8 INERTIA BASE

.1 Type B3 - Full depth perimeter structural or formed channels, frames: welded in place reinforcing rods running in both directions; spring mounted, carried by gussetted

2.8 INERTIA BASE (Cont'd)

.1 (Cont'd)
height-saving brackets welded to frame; and clear housekeeping pads by 50 mm minimum.

.2 Pump bases: "T" shaped, where applicable, to provide support for elbows.

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Install vibration isolation equipment in accordance with manufacturers instructions and adjust mountings to level equipment.

.2 Ensure piping, ducting and electrical connections to isolated equipment do not reduce system flexibility and that piping, conduit and ducting passage through walls and floors do not transmit vibrations.

.3 Unless indicated otherwise, support piping connected to isolated equipment with spring mounts or spring hangers with 25 mm minimum static deflection as follows:
.1 Up to NPS4: first 3 points of support. NPS5 to NPS8: first 4 points of support. NPS10 and Over: first 6 points of support.
.2 First point of support shall have a static deflection of twice deflection of isolated equipment, but not more than 50 mm.

.4 Where isolation is bolted to floor use vibration isolation rubber washers.

.5 Block and shim level bases so that ductwork and piping connections can be made to a rigid system at the operating level, before isolator adjustment is made. Ensure that there is no physical contact between isolated equipment and building structure.

END

PART 1 - GENERAL

1.1 REFERENCES

.1 Canadian Standards Association (CSA)
.1 CAN/CSA-B149.1-10, Natural Gas and Propane Installation Code.

.2 Canadian General Standards Board (CGSB)
.1 CAN/CGSB-1.60-97, Interior Alkyd Gloss Enamel.
.2 CAN/CGSB-24.3-92, Identification of Piping Systems.

.3 National Fire Protection Association (NFPA)
.1 NFPA 13-2013, Standard for the Installation of Sprinkler Systems.
.2 NFPA 14-2013, Standard for the Installation of Standpipe and Hose Systems.

1.2 SUBMITTALS

.1 Product Data: submit product data for each item specified.

.2 Submittals: in accordance with Section 01 33 00.

.3 Product data to include paint colour chips, other products specified in this section.

.4 Samples:
.1 Submit samples in accordance with Section 01 33 00.
.2 Samples to include nameplates, labels, tags, lists of proposed legends.

1.3 QUALITY ASSURANCE

.1 Quality assurance submittals: submit following in accordance with Section 01 33 00.

1.4 DELIVERY, STORAGE, AND HANDLING

.1 Packing, shipping, handling and unloading:
.1 Deliver, store and handle in accordance with Section 01 61 00.
.2 Deliver, store and handle materials in accordance with manufacturer's written instructions.

PART 2 - PRODUCTS

2.1 MANUFACTURER'S EQUIPMENT NAMEPLATES

.1 Metal or plastic laminate nameplate mechanically fastened to each piece of equipment by manufacturer.

.2 Lettering and numbers raised or recessed.

.3 Information to include, as appropriate:
.1 Equipment: manufacturer's name, model, size, serial number, capacity.
.2 Motor: voltage, Hz, phase, power factor, duty, frame size.

2.2 SYSTEM NAMEPLATES

.1 Colours:
.1 Elsewhere: black letters, white background (except where required otherwise by applicable codes).

.2 Construction:
.1 3 mm thick laminated plastic or white anodized aluminum, matte finish, with square corners, letters accurately aligned and machine engraved into core.

.3 Sizes:
.1 Conform to following table:

Size # mm	Sizes (mm)	No. of Lines	Height of Letters (mm)
1	10 x 50	1	3
2	13 x 75	1	5
3	13 x 75	2	3
4	20 x 100	1	8
5	20 x 100	2	5
6	20 x 200	1	8
7	25 x 125	1	12
8	25 x 125	2	8
9	35 x 200	1	20

.2 Use maximum of 25 letters/numbers per line.

.4 Locations:
.1 Terminal cabinets, control panels: use size #5.
.2 Equipment in Mechanical Rooms: use size #9.

2.2 SYSTEM NAMEPLATES (Cont'd)

.5 Identification for PWGSC Preventive Maintenance Support System (PMSS):
.1 Use arrangement of Main identifier, Source identifier, Destination identifier.
.2 Equipment in Mechanical Room:
.1 Main identifier: size #9.
.2 Source and Destination identifiers: size #6.
.3 Terminal cabinets, control panels: size #5.
.3 Equipment elsewhere: sizes as appropriate.

2.3 EXISTING IDENTIFICATION SYSTEMS

.1 Apply existing identification system to new work.

.2 Where existing identification system does not cover for new work, use identification system specified this section.

.3 Before starting work, obtain written approval of identification system from Departmental Representative.

2.4 PIPING SYSTEMS

.1 Identification:
.1 Sprinklers: to NFPA 13.
.2 Standpipe and hose systems: to NFPA 14.

2.5 IDENTIFICATION OF PIPING SYSTEMS

.1 Identify contents by background colour marking, pictogram (as necessary), legend; direction of flow by arrows. To CAN/CGSB-24.3 except where specified otherwise.

.2 Pictograms:
.1 Where required: Workplace Hazardous Materials Information System (WHMIS) regulations.

.3 Legend:
.1 Block capitals to sizes and colours listed in CAN/CGSB-24.3.

.4 Arrows showing direction of flow:
.1 Outside diameter of pipe or insulation less than 75 mm: 100 mm long x 50 mm high.
.2 Outside diameter of pipe or insulation 75 mm and greater: 150 mm long x 50 mm high.
.3 Use double-headed arrows where flow is reversible.

2.5 IDENTIFICATION OF PIPING SYSTEMS (Cont'd)

.5 Extent of background colour marking:
.1 To full circumference of pipe or insulation.
.2 Length to accommodate pictogram, full length of legend and arrows.

.6 Materials for background colour marking, legend, arrows:
.1 Pipes and tubing 20 mm and smaller: waterproof and heat-resistant pressure sensitive plastic marker tags.
.2 Other pipes: pressure sensitive plastic-coated cloth vinyl with protective overcoating, waterproof contact adhesive undercoating, suitable for ambient of 100% RH and continuous operating temperature of 150 degrees C and intermittent temperature of 200 degrees C.

.7 Colours and Legends:
.1 Where not listed, obtain direction from Departmental Representative.
.2 Colours for legends, arrows: to following table:

Background colour:	Legend, arrows:
Yellow	BLACK
Green	WHITE
Red	WHITE

.3 Background colour marking and legends for piping systems:

Contents	Background colour marking	Legend
Treated water	Green	TREATED WATER
Chilled water supply	Green	CH. WTR. SUPPLY
Chilled water return	Green	CH. WTR. RETURN
Hot water heating supply	Yellow	HEATING SUPPLY
Hot water heating return	Yellow	HEATING RETURN
Make-up water	Yellow	MAKE-UP WTR
Steam kPa	Yellow	kPa STEAM
Steam condensate (gravity)	Yellow	ST.COND.RET
Domestic cold water supply	Green	DOM. CWS
Sanitary	Green	SAN
Plumbing vent	Green	SAN. VENT
RO water	Green	RO WATER
Compressed air (<700kPa)	Green	COMP. AIR
Compressed air (>700kPa)	Yellow	COMP. AIR
Fire protection water	Red	FIRE PROT. WTR
Sprinklers	Red	SPRINKLERS

2.6 IDENTIFICATION DUCTWORK SYSTEMS

.1 50 mm high stencilled letters and directional arrows 150 mm long x 50 mm high.

.2 Colours: back, or co-ordinated with base colour to ensure strong contrast.

2.7 VALVES, CONTROLLERS

.1 Brass tags with 12 mm stamped identification data filled with black paint.

.2 Include flow diagrams for each system, of approved size, showing charts and schedules with identification of each tagged item, valve type, service, function, normal position, location of tagged item.

2.8 CONTROLS COMPONENTS IDENTIFICATION

.1 Identify all systems, equipment, components, controls, sensors with system nameplates specified in this section.

.2 Inscriptions to include function and (where appropriate) fail-safe position.

2.9 LANGUAGE

.1 Identification in English and French.

.2 Use one nameplate and label for each language both languages.

PART 3 - EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 TIMING

.1 Provide identification only after painting has been completed.

3.3 INSTALLATION

.1 Perform work in accordance with CAN/CGSB-24.3 except as specified otherwise.

3.3 INSTALLATION (Cont'd)

.2 Provide ULC and or CSA registration plates as required by respective agency.

.3 Identify systems, equipment to conform to PWGSC PMSS.

3.4 NAMEPLATES

.1 Locations:
.1 In conspicuous location to facilitate easy reading and identification from operating floor.

.2 Standoffs:
.1 Provide for nameplates on hot and/or insulated surfaces.

.3 Protection:
.1 Do not paint, insulate or cover.

3.5 LOCATION OF IDENTIFICATION ON PIPING AND DUCTWORK SYSTEMS

.1 On long straight runs in open areas in boiler rooms, equipment rooms, galleries, tunnels: at not more than 17 m intervals and more frequently if required to ensure that at least one is visible from any one viewpoint in operating areas and walking aisles.

.2 Adjacent to each change in direction.

.3 At least once in each small room through which piping or ductwork passes.

.4 On both sides of visual obstruction or where run is difficult to follow.

.5 On both sides of separations such as walls, floors, partitions.

.6 Where system is installed in pipe chases, ceiling spaces, galleries, confined spaces, at entry and exit points, and at access openings.

.7 At beginning and end points of each run and at each piece of equipment in run.

.8 At point immediately upstream of major manually operated or automatically controlled valves, and dampers. Where this is not possible, place identification as close as possible, preferably on upstream side.

3.5 LOCATION OF IDENTIFICATION ON PIPING AND DUCTWORK SYSTEMS (Cont'd)

.9 Identification easily and accurately readable from usual operating areas and from access points.

.1 Position of identification approximately at right angles to most convenient line of sight, considering operating positions, lighting conditions, risk of physical damage or injury and reduced visibility over time due to dust and dirt.

3.6 VALVES, CONTROLLERS

.1 Valves and operating controllers, except at plumbing fixtures, radiation, or where in plain sight of equipment they serve: Secure tags with non-ferrous chains or closed "S" hooks.

.2 Install one copy of flow diagrams, valve schedules mounted in frame behind non-glare glass where directed by Departmental Representative. Provide one copy (reduced in size if required) in each operating and maintenance manual.

.3 Number valves in each system consecutively.

END

PART 1 - GENERAL

1.1 GENERAL

.1 TAB means to test, adjust and balance to perform in accordance with requirements of Contract Documents and to do other work as specified in this section.

1.2 QUALIFICATIONS OF TAB PERSONNEL

.1 Names of personnel it is proposed to perform TAB to be submitted to and approved by Departmental Representative Consultant within 90 days of award of contract.

.2 Provide documentation confirming qualifications, successful experience.

1.3 PURPOSE OF TAB

.1 Test to verify proper and safe operation, determine actual point of performance, evaluate qualitative and quantitative performance of equipment, systems and controls at design, average and low loads using actual or simulated loads

.2 Adjust and regulate equipment and systems so as to meet specified performance requirements and to achieve specified interaction with other related systems under normal and emergency loads and operating conditions.

.3 Balance systems and equipment to regulate flow rates to match load requirements over full operating ranges.

1.4 EXCEPTIONS

.1 TAB of systems and equipment regulated by codes, standards to be to satisfaction of authority having jurisdiction.

1.5 CO-ORDINATION

.1 Schedule time required for TAB (including repairs, re-testing) into project construction and completion schedule so as to ensure completion before acceptance of project.

.2 Do TAB of each system independently and subsequently, where interlocked with other systems, in unison with those systems.

1.6 PRE-TAB REVIEW

.1 Review contract documents before project construction is started and confirm in writing to Departmental Representative Consultant adequacy of provisions for TAB and other aspects of design and installation pertinent to success of TAB.

.2 Review specified standards and report to Departmental Representative Consultant in writing all proposed procedures which vary from standard.

.3 During construction, co-ordinate location and installation of TAB devices, equipment, accessories, measurement ports and fittings.

1.7 START-UP

.1 Follow start-up procedures as recommended by equipment manufacturer unless specified otherwise.

.2 Follow special start-up procedures specified elsewhere in Mechanical Division.

1.8 OPERATION OF SYSTEMS DURING TAB

.1 Operate systems for length of time required for TAB and as required by Departmental Representative Consultant for verification of TAB reports.

1.9 START OF TAB

.1 Notify Departmental Representative Consultant 7 days prior to start of TAB.

.2 Start TAB when building is essentially completed, including:

.3 Installation of ceilings, doors, windows, other construction affecting TAB.

.4 Application of weatherstripping, sealing, caulking.

.5 All pressure, leakage, other tests specified elsewhere in Division 23.

.6 All provisions for TAB installed and operational.

.7 Start-up, verification for proper, normal and safe operation of mechanical and associated

1.9 START OF TAB (Cont'd)

.7 (Cont'd)
electrical and control systems affecting TAB including but not limited to:
.1 Proper thermal overload protection in place for electrical equipment.
.2 Air systems:
.1 Filters in place, clean.
.2 Duct systems clean.
.3 Ducts, air shafts, ceiling plenums are airtight to within specified tolerances.
.4 Correct fan rotation.
.5 Fire, smoke, volume control dampers installed and open.
.6 Coil fins combed, clean.
.7 Access doors, installed, closed.
.8 Outlets installed, volume control dampers open.
.3 Liquid systems:
.1 Flushed, filled, vented.
.2 Correct pump rotation.
.3 Strainers in place, baskets clean.
.4 Isolating and balancing valves installed, open.
.5 Calibrated balancing valves installed, at factory settings.
.6 Chemical treatment systems complete, operational.

1.10 APPLICATION TOLERANCES

.1 Do TAB to following tolerances of design values:
.1 Laboratory HVAC systems: plus 10%, minus 0%.
.2 Other HVAC systems: plus 5%, minus 5 %.
.3 Hydronic systems: plus or minus 10%.
.4.

1.11 ACCURACY TOLERANCES

.1 Measured values to be accurate to within plus or minus 2% of actual values.

1.12 INSTRUMENTS

.1 Prior to TAB, submit to Departmental Representative Consultant list of instruments to be used together with serial numbers.

.2 Calibrate in accordance with requirements of most stringent of referenced standard for either applicable system or HVAC system.

1.12 INSTRUMENTS (Cont'd)

.3 Calibrate within 3 months of TAB. Provide certificate of calibration to Departmental Representative Consultant.

1.13 SUBMITTALS

.1 Submit, prior to commencement of TAB:

.2 Proposed methodology and procedures for performing TAB if different from referenced standard.

.3.

1.14 PRELIMINARY TAB REPORT

.1 Submit for checking and approval of Departmental Representative Consultant, prior to submission of formal TAB report, sample of rough TAB sheets. Include:
- .1 Details of instruments used.
- .2 Details of TAB procedures employed.
- .3 Calculations procedures.
- .4 Summaries.

1.15 TAB REPORT

.1 Format to be in accordance with referenced standard.

.2 TAB report to show results in SI units and to include:
- .1 Project record drawings.
- .2 System schematics.

.3 Submit 6 copies of TAB Report to Departmental Representative Consultant for verification and approval, in English French both official languages in D-ring binders, complete with index tabs.

1.16 VERIFICATION

.1 Reported results subject to verification by Departmental Representative Consultant.

.2 Provide manpower and instrumentation to verify up to 30% of reported results.

.3 Number and location of verified results to be at discretion of Departmental Representative Consultant.

1.16 VERIFICATION (Cont'd)

.4 Bear costs to repeat TAB as required to satisfaction of Departmental Representative Consultant.

1.17 SETTINGS

.1 After TAB is completed to satisfaction of Departmental Representative Consultant, replace drive guards, close access doors, lock devices in set positions, ensure sensors are at required settings.

.2 Permanently mark settings to allow restoration at any time during life of facility. Markings not to be eradicated or covered in any way.

1.18 COMPLETION OF TAB

.1 TAB to be considered complete when final TAB Report received and approved by Departmental Representative.

1.19 AIR SYSTEMS

.1 Standard: TAB to be to most stringent of this section or TAB standards of AABC NEBB SMACNA ASHRAE.

.2 Do TAB of systems, equipment, components, controls specified Division 21 22 23 following systems, equipment, components, controls:
.1 New air handler and associated return fan
.2 Air and distribution in area being renovated.

.3 Qualifications: personnel performing TAB to be current member in good standing of AABC or NEBB qualified to standards of AABC or NEBB.

.4 Quality assurance: Perform TAB under direction of supervisor qualified by to standards of AABC or NEBB.

.5 Measurements: to include, but not limited to, following as appropriate for systems, equipment, components, controls: air velocity, static pressure, flow rate, pressure drop (or loss), temperatures (dry bulb, wet bulb, dewpoint), duct cross-sectional area, RPM, electrical power, voltage, noise, vibration.

1.19 AIR SYSTEMS (Cont'd)

.6 Locations of equipment measurements: To include, but not be limited to, following as appropriate:
.1 Inlet and outlet of dampers, filter, coil, humidifier, fan, other equipment causing changes in conditions.
.2 At controllers, controlled device.

.7 Locations of systems measurements to include, but not be limited to, following as appropriate: Main ducts, main branch, sub-branch, run-out (or grille, register or diffuser).

1.20 HYDRONIC SYSTEMS

.1 Definitions: for purposes of this section, to include low pressure hot water heating, chilled water, condenser water, glycol systems.

.2 Standard: TAB to be to most stringent of this section or TAB standards of AABC NEBB SMACNA ASHRAE.

.3 Do TAB of systems, equipment, components, controls specified Division 25 following systems, equipment, components, controls:
.1 Hydronic system associated with new air handler.
.2 Hydronic system in area being renovated.

.4 Qualifications: personnel performing TAB to be current member in good standing of AABC or NEBB qualified to standards of AABC or NEBB.

.5 Quality assurance: perform TAB under direction of supervisor qualified by to standards of AABC or NEBB.

.6 Measurements: to include, but not limited to, following as appropriate for systems, equipment, components, controls: Flow rate, static pressure, pressure drop (or loss), temperature, specific gravity, density, RPM, electrical power, voltage, noise, vibration.

.7 Locations of equipment measurement: To include, but not be limited to, following as appropriate:
.1 Inlet and outlet of coil, humidifier, pump, control valve, other equipment causing changes in conditions.
.2 At controllers, controlled device.

1.21 OTHER TAB REQUIREMENTS

.1 General requirements applicable to work specified this paragraph:

.1 Qualifications of TAB personnel: as for air systems specified this section.

.2 Quality assurance: as for air systems specified this section.

PART 2 - PRODUCTS

2.1 NOT USED

.1 Not used.

PART 3 - EXECUTION

3.1 NOT USED

.1 Not used.

END

PART 1 - GENERAL

1.1 REFERENCES

.1 Definitions:
- .1 For purposes of this section:
  - .1 "CONCEALED" - insulated mechanical services and equipment in suspended ceilings and non-accessible chases and furred-in spaces.
  - .2 "EXPOSED" - means "not concealed" as previouslydefined.
  - .3 Insulation systems - insulation material, fasteners, jackets, and other accessories.
- .2 TIAC Codes:
  - .1 CRD: Code Round Ductwork,
  - .2 CRF: Code Rectangular Finish.

.2 Reference Standards:
- .1 American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE)
  - .1 ANSI/ASHRAE/IES 90.1-2013, SI; Energy Standard for Buildings Except Low-Rise Residential Buildings.
- .2 ASTM International Inc.
  - .1 ASTM B209M-10, Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric).
  - .2 ASTM C335-10e1, Standard Test Method for Steady State Heat Transfer Properties of Pipe Insulation.
  - .3 ASTM C411-11, Standard Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation.
  - .4 ASTM C449-07, Standard Specification for Mineral Fiber-Hydraulic- Setting Thermal Insulating and Finishing Cement.
  - .5 ASTM C547-11, Standard Specification for Mineral Fiber Pipe Insulation.
  - .6 ASTM C553-11, Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.
  - .7 ASTM C612-10, Standard Specification for Mineral Fiber Block and Board Thermal Insulation.
  - .8 ASTM C921-10, Standard Practice for Determining the Properties of Jacketing Materials for Thermal Insulation.
- .3 Canadian General Standards Board (CGSB)
  - .1 CGSB 51-GP-52Ma-89, Vapour Barrier, Jacket and Facing Material for Pipe, Duct and Equipment Thermal Insulation.

1.1 REFERENCES (Cont'd)

.2 Reference Standards:(Cont'd)

.4 Thermal Insulation Association of Canada (TIAC): National Insulation Standards (2005).

.5 Underwriters Laboratories of Canada (ULC)

.1 CAN/ULC-S102-10, Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.

.2 CAN/ULC-S701-11, Standard for Thermal Insulation, Polystyrene, Boards and Pipe Covering.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00.

.2 Product Data:

.1 Provide manufacturer's printed product literature and datasheets for duct insulation, and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Manufacturers' Instructions:

.1 Provide manufacture's written duct insulation jointing recommendations. and special handling criteria, installation sequence, cleaning procedures.

1.3 QUALITY ASSURANCE

.1 Qualifications:

.1 Installer: specialist in performing work of this section, and have at least 3 years successful experience in this size and type of project, qualified to standards member of TIAC.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle in accordance with Section 01 61 00.

.2 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address and ULC markings.

PART 2 - PRODUCTS

2.1 FIRE AND SMOKE RATING

.1 To CAN/ULC-S102:
- .1 Maximum flame spread rating: 25.
- .2 Maximum smoke developed rating: 50.

2.2 INSULATION

.1 Mineral fibre: as specified includes glass fibre, rock wool, slag wool.
- .1 Recycled content: % (Post-Consumer + ½ Post-Industrial) in accordance with Section 01 35 21.

.2 Thermal conductivity ("k" factor) not to exceed specified values at 24°C mean temperature when tested in accordance with ASTM C335.

.3 TIAC Code C-1: Rigid mineral fibre board to ASTM C612, with without factory applied vapour retarder jacket to CGSB 51-GP-52Ma (as scheduled in PART 3 of this Section).

.4 TIAC Code C-2: Mineral fibre blanket to ASTM C553 faced with without factory applied vapour retarder jacket to CGSB 51-GP-52Ma (as scheduled in PART 3 of this section).
- .1 Mineral fibre: to ASTM C553.
- .2 Jacket: to CGSB 51-GP-52Ma.
- .3 Maximum "k" factor: to ASTM C553.

2.3 JACKETS

.1 Canvas:
- .1 220 gm/m^2 cotton, plain weave, treated with dilute fire retardant lagging adhesive to ASTM C921.

.2 Lagging adhesive: compatible with insulation.

2.4 ACCESSORIES

.1 Vapour retarder lap adhesive:
- .1 Water based, fire retardant type, compatible with insulation.

.2 Indoor Vapour Retarder Finish:
- .1 Vinyl emulsion type acrylic, compatible with insulation.

.3 Insulating Cement: hydraulic setting on mineral wool, to ASTM C449.

2.4 ACCESSORIES (Cont'd)

.4 ULC Listed Canvas Jacket:
.1 220 gm/m^2 cotton, plain weave, treated with dilute fire retardant lagging adhesive to ASTM C921 untreated.

.5 Tape: self-adhesive, aluminum reinforced, 50 mm wide minimum.

.6 Contact adhesive: quick-setting
.1 Maximum VOC limit 250 g/L to SCAQMD Rule 1168 GSES GS-36.

.7 Canvas adhesive: washable.
.1 Maximum VOC limit 250 g/L to SCAQMD Rule 1168 GSES GS-36.

.8 Tie wire: 1.5 mm stainless steel.

.9 Banding: 19 mm wide, 0.5 mm thick stainless steel.

.10 Facing: 25 mm stainless steel hexagonal wire mesh stitched on both faces of insulation.

.11 Fasteners: 4 mm diameter pins with 35 mm diameter or clips, length to suit thickness of insulation.

PART 3 - EXECUTION

3.1 APPLICATION

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

3.2 PRE-INSTALLATION REQUIREMENTS

.1 Pressure test ductwork systems complete, witness and certify.

.2 Ensure surfaces are clean, dry, free from foreign material.

3.3 INSTALLATION

.1 Install in accordance with TIAC National Standards.

.2 Apply materials in accordance with manufacturers instructions and as indicated.

3.3 INSTALLATION (Cont'd)

.3 Use 2 layers with staggered joints when required nominal thickness exceeds 75 mm.

.4 Maintain uninterrupted continuity and integrity of vapour retarder jacket and finishes.
.1 Ensure hangers, and supports are outside vapour retarder jacket.

.5 Hangers and supports in accordance with Section 23 05 29.
.1 Apply high compressive strength insulation where insulation may be compressed by weight of ductwork.

.6 Fasteners: install at 300 mm on centre in horizontal and vertical directions, minimum 2 rows each side.

3.4 DUCTWORK INSULATION SCHEDULE

.1 Insulation types and thicknesses: conform to following table:

	TIAC Code	Vapour Retarder	Thickness (mm)
Rectangular cold and dual temperature supply air ducts	C-1	yes	50
Round cold and dual temperatire supply air ducts	C-2	yes	50
Supply, return and exhaust ducts exposed in space being served			none
Outside air ducts to mixing plenum	C-1	yes	50
Mixing plenums	C-1	yes	50
Exhaust duct between dampers and louvres	C-1	no	25
Rectangular ducts outside	C-1	special	50
Acoustically lined ducts	none		

3.4 DUCTWORK INSULATION SCHEDULE (Cont'd) .1 (Cont'd)

.2 Exposed round ducts 600 mm and larger, smaller sizes where subject to abuse:
.1 Use TIAC code C-1 insulation, scored to suit diameter of duct.
.1 Finishes: conform to following table:

	TIAC Code	
	Rectangular	Round
Indoor, concealed	none	none
Indoor, exposed within mechanical room	CRF/1	CRD/2
Indoor, exposed elsewhere	CRF/2	CRD/3

3.5 JACKETS .1 All exposed ductwork shall be provided with canvas jacket and lagging.

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

END

PART 1 - GENERAL

1.1 SUMMARY

.1 Section Includes:
.1 Thermal insulation for piping and piping accessories in commercial type applications.

1.2 REFERENCES

.1 American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE)
.1 ASHRAE Standard 90.1-2013, Energy Standard for Buildings Except Low-Rise Residential Buildings (ANSI approved; IESNA co-sponsored.

.2 American Society for Testing and Materials International (ASTM)
.1 ASTM B209M-10, Standard Specification for Aluminum and Aluminum Alloy Sheet and Plate (Metric).
.2 ASTM C335/C335M-10e1, Standard Test Method for Steady State Heat Transfer Properties of Horizontal Pipe Insulation.
.3 ASTM C411-11, Standard Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation.
.4 ASTM C449-07, Standard Specification for Mineral Fiber-Hydraulic-Setting Thermal Insulating and Finishing Cement.
.5 ASTM C533-07, Standard Specification for Calcium Silicate Block and Pipe Thermal Insulation.
.6 ASTM C547-07e1, Standard Specification for Mineral Fiber Pipe Insulation.
.7 ASTM C795-08, Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel.
.8 ASTM C921-10, Standard Practice for Determining the Properties of Jacketing Materials for Thermal Insulation.

.3 Canadian General Standards Board (CGSB)
.1 CGSB 51-GP-52Ma-89, Vapour Barrier, Jacket and Facing Material for Pipe, Duct and Equipment Thermal Insulation.
.2 CAN/CGSB-51.53-95, Poly (Vinyl Chloride) Jacketing Sheet, for Insulated Pipes, Vessels and Round Ducts.

.4 Department of Justice Canada (Jus)
.1 Canadian Environmental Assessment Act (CEAA), 1992, c. 37.

1.2 REFERENCES (Cont'd)

.4 (Cont'd)
.2 Canadian Environmental Protection Act (CEPA), 1999, c. 33.
.3 Transportation of Dangerous Goods Act (TDGA), 1992, c. 34.

.5 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
.1 Material Safety Data Sheets (MSDS).

.6 Manufacturer's Trade Associations
.1 Thermal Insulation Association of Canada (TIAC): Mechanical Insulation Best Practice Guide(Revised 2005).

.7 Underwriters' Laboratories of Canada (ULC)
.1 CAN/ULC-S102-10, Standard Method of Test for Surface Burning Characteristics of Flooring, Floor Coverings, and Miscellaneous Materials and Assemblies.
.2 CAN/ULC-S701-11, Standard for Thermal Insulation, Polystyrene, Boards and Pipe Covering.
.3 CAN/ULC-S702-09, Thermal Insulation, Mineral Fibre, for Buildings
.4 ULC-S702.2-10, Standard for Thermal Insulation, Mineral Fibre, for Buildings, Part 2: Application Guidelines.

1.3 DEFINITIONS

.1 For purposes of this section:
.1 "CONCEALED" - insulated mechanical services in suspended ceilings and non-accessible chases and furred-in spaces.
.2 "EXPOSED" - will mean "not concealed" as specified.

.2 TIAC ss:
.1 CRF: Code Rectangular Finish.
.2 CPF: Code Piping Finish.

1.4 SUBMITTALS

.1 Submittals: in accordance with Section 01 33 00.

.2 Product Data:
.1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 33 00. Include

1.4 SUBMITTALS (Cont'd)

.2 Product Data:(Cont'd)
.1 (Cont'd)
product characteristics, performance criteria, and limitations.
.1 Submit two copies of Workplace Hazardous Materials Information System (WHMIS) Material Safety Data Sheets (MSDS).

.3 Shop Drawings:
.1 Submit shop drawings in accordance with Section 01 33 00.
.1 Shop drawings: submit drawings stamped and signed by professional engineer registered or licensed in Province of Ontario, Canada.

1.5 QUALITY ASSURANCE

.1 Qualifications:
.1 Installer: specialist in performing work of this Section, and have at least 3 years successful experience in this size and type of project, qualified to standards member of TIAC.

.2 Health and Safety:
.1 Do construction occupational health and safety in accordance with Section 01 35 29.06.

1.6 DELIVERY, STORAGE AND HANDLING

.1 Packing, shipping, handling and unloading:
.1 Deliver, store and handle in accordance with manufacturer's written instructions and Section 01 61 00.
.2 Deliver, store and handle materials in accordance with manufacturer's written instructions.
.3 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.

.2 Storage and Protection:
.1 Protect from weather, construction traffic.
.2 Protect against damage.
.3 Store at temperatures and conditions required by manufacturer.

PART 2 - PRODUCTS

2.1 FIRE AND SMOKE RATING

.1 In accordance with CAN/ULC-S102.
- .1 Maximum flame spread rating: 25.
- .2 Maximum smoke developed rating: 50.

2.2 INSULATION

.1 Mineral fibre specified includes glass fibre, rock wool, slag wool.

.2 Thermal conductivity ("k" factor) not to exceed specified values at 24°C mean temperature when tested in accordance with ASTM C335.

.3 TIAC Code A-1: rigid moulded mineral fibre without factory applied vapour retarder jacket.
- .1 Mineral fibre: to CAN/ULC-S702 ASTM C547.
- .2 Maximum "k" factor: to CAN/ULC-S702.

.4 TIAC Code A-3: rigid moulded mineral fibre with factory applied vapour retarder jacket.
- .1 Mineral fibre: to CAN/ULC-S702 ASTM C547.
- .2 Jacket: to CGSB 51-GP-52Ma.
- .3 Maximum "k" factor: to CAN/ULC-S702 ASTM C547.

.5 TIAC Code C-2: mineral fibre blanket faced with without factory applied vapour retarder jacket (as scheduled in PART 3 of this section).
- .1 Mineral fibre: to CAN/ULC-S702 ASTM C547.
- .2 Jacket: to CGSB 51-GP-52Ma.
- .3 Maximum "k" factor: to CAN/ULC-S702 ASTM C547.

.6 TIAC Code A-6: flexible unicellular tubular elastomer.

.7 Insulation: with vapour retarder jacket
- .1 Jacket: to CGSB 51-GP-52Ma.
- .2 Maximum "k" factor:.
- .3 Certified by manufacturer: free of potential stress corrosion cracking corrodants.

2.3 INSULATION SECUREMENT

.1 Tape: self-adhesive, aluminum, plain reinforced, 50 mm wide minimum.

.2 Contact adhesive: quick setting.

.3 Canvas adhesive: washable.

2.3 INSULATION SECUREMENT (Cont'd)

.4 Tie wire: 1.5 mm diameter stainless steel.

.5 Bands: stainless steel, 19 mm wide, 0.5 mm thick.

2.4 CEMENT

.1 Thermal insulating and finishing cement:
.1 Hydraulic setting or Air drying on mineral wool, to ASTM C449.

2.5 VAPOUR RETARDER LAP ADHESIVE

.1 Water based, fire retardant type, compatible with insulation.

2.6 INDOOR VAPOUR RETARDER FINISH

.1 Vinyl emulsion type acrylic, compatible with insulation.

2.7 JACKETS

.1 Polyvinyl Chloride (PVC):
.1 One-piece moulded type and sheet to CAN/CGSB-51.53 with pre-formed shapes as required.
.2 Colours: to match adjacent finish paint by Departmental Representative.
.3 Minimum service temperatures: -20 degrees C.
.4 Maximum service temperature: 65 degrees C.
.5 Moisture vapour transmission: 0.02 perm.
.6 Thickness: mm.
.7 Fastenings:
.1 Use solvent weld adhesive compatible with insulation to seal laps and joints.
.2 Tacks.
.3 Pressure sensitive vinyl tape of matching colour.
.8 Special requirements:
.1 Indoor:.
.2 Outdoor: UV rated material at least 0.5 mm thick.

.2 Canvas:
.1 220 gm/m^2 cotton, plain weave, treated with dilute fire retardant lagging adhesive to ASTM C921.
.2 Lagging adhesive: compatible with insulation.

2.8 FIRE RATED DUCTWORK

.1 Where piping is indicated to be fire rated on the plans, they shall be provided with a fire rated wrap consisting of 40mm thick, noncombustable, flexible fireproof blanket, supplied in roll form. Provide sufficient number of layers to ensure the wrap provides the required fire separation.

.2 Apply wrap directly onto the ductwork piping in strict accordance with the manufacturer's recommendation and ULC listing, Design No. FRD 4 Guide No. 40 U21 "FIRE RESISTANT DUCTS" as tested to ISO Standard 6944 and ULC Guide No. 440E9 per 0 mm clearance to combustables.

.3 Provide an aluminum foil face to exposed surface.

.4 All hangers, support rods, concrete anchors and fire-stopping of duct penetrations through fire separations shall be in accordance with ULC listing and manufacturer's instructions.

PART 3 - EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 PRE-INSTALLATION REQUIREMENT

.1 Pressure testing of piping systems and adjacent equipment to be complete, witnessed and certified.

.2 Surfaces clean, dry, free from foreign material.

3.3 INSTALLATION

.1 Install in accordance with TIAC National Standards.

.2 Apply materials in accordance with manufacturers instructions and this specification.

3.3 INSTALLATION (Cont'd)

.3 Use two layers with staggered joints when required nominal wall thickness exceeds 75 mm.

.4 Maintain uninterrupted continuity and integrity of vapour retarder jacket and finishes.
.1 Install hangers, supports outside vapour retarder jacket.

.5 Supports, Hangers:
.1 Apply high compressive strength insulation, suitable for service, at oversized saddles and shoes where insulation saddles have not been provided.

3.4 FIRE RATED DUCTWORK/PIPING

.1 Install in accordance with manufacturer's recommendations.

.2 Manufacturer's representative shall visit the site during installation and submit deficiency report.

.3 Upon completion of each section of the work, manufacturer's representative shall submit signed certification confirming installation is in accordance with their requirement.

3.5 REMOVABLE, PRE-FABRICATED, INSULATION AND ENCLOSURES

.1 Application: valves, primary flow measuring elements flanges and unions at equipment.

.2 Design: to permit periodic removal and replacement without damage to adjacent insulation.

.3 Insulation:
.1 Insulation, fastenings and finishes: same as system.
.2 Jacket: PVC, ABS high temperature fabric.

3.6 INSTALLATION OF ELASTOMERIC INSULATION

.1 Insulation to remain dry. Overlaps to manufacturers instructions. Ensure tight joints.

.2 Provide vapour retarder as recommended by manufacturer.

3.7 PIPING INSULATION SCHEDULES

.1 Includes valves, valve bonnets, strainers, flanges and fittings unless otherwise specified.

.2 TIAC Code: A-1.
.1 Securements: SS wire bands at 300 mm on centre.
.2 Seals: lap seal adhesive, lagging adhesive.
.3 Installation: TIAC Code 1501-H.

.3 TIAC Code: A-3.
.1 Securements: SS wire bands at 300 mm on centre.
.2 Seals: VR lap seal adhesive, VR lagging adhesive.
.3 Installation: TIAC Code: 1501-C.

.4 TIAC Code: C-2 with without vapour retarder jacket.
.1 Insulation securements:.
.2 Seals: lap seal adhesive, lagging adhesive.
.3 Installation: TIAC Code: 1501-C.

.5 Thickness of insulation as listed in following table.
.1 Run-outs to individual units and equipment not exceeding 4000 mm long.
.2 Do not insulate exposed runouts to plumbing fixtures, chrome plated piping, valves, fittings.

Application	Temp degrees C	TIAC code	Pipe sizes (NPS) and insulation thickness (mm)			
	Run out	to 1	1 1/4 to 2	2 1/2 to 4		over
Steam	up to 175	A- 1	50	50	65	75
Condensate Return	60 - 94	A- 1	25	38	38	38
Hot Water Heatin	60 - 94	A- 1	25	38	38	38
Hot Water Heatin	up to 59	A- 1	25	25	25	25

3.7 PIPING INSULATION SCHEDULES (Cont'd)

.5 (Cont'd)
.2 (Cont'd)

Domestic HWS	A- 1	25	25	25	38
Chille Water	A- 3	25	38	38	25
Chilled Water Pump Casing	A- 3	25	25	25	25
Domestic CWS with vapour retarder	C- 2	25	25	25	25
Cooling Coil cond. drain	C- 2	25	25	25	25

.6 Finishes:
.1 Exposed indoors: hot water, PVC jacket.
.2 Exposed in mechanical rooms: canvas for steam PVC jacket for hot and chilled water.
.3 Concealed, indoors: canvas on valves, fittings. No further finish.
.4 Use vapour retarder jacket on TIAC code A-3 insulation compatible with insulation.
.5 Finish attachments: SS screws bands, at 150 mm on centre. Seals: wing closed.
.6 Installation: to appropriate TIAC code CRF/1 through CPF/5.

3.8 CLEANING

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

3.8 CLEANING (Cont'd)

.2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END

PART 1 - GENERAL

1.1 RELATED SECTIONS

.1 Section 01 91 00 - Commissioning: General Requirements, supplemented as specified herein.

.2 Section 23 08 02 - Cleaning and Start-up of Mechanical Piping Systems.

.3 Section 22 42 01 - Plumbing Specialities and Accessories.

.4 Section 23 05 93 - Testing, Adjusting and Balancing for HVAC.

1.2 CLEANING AND START-UP OF MECHANICAL PIPING SYSTEMS

.1 In accordance with Section 23 08 02.

1.3 HYDRONIC SYSTEMS - PERFORMANCE VERIFICATION (PV)

.1 Timing:
.1 After cleaning is completed and system is in full operation.

.2 When systems are operational, perform following tests:
.1 Conduct full scale tests at maximum design flow rates, temperatures and pressures for continuous consecutive period of 48 hours to demonstrate compliance with design criteria.
.2 Verify performance of hydronic system circulating pumps as specified in relevant technical sections, recording system pressures, temperatures, fluctuations by simulating maximum design conditions and varying.
.1 Pump operation.
.2 Control pressure failure.
.3 Maximum heating demand.
.4 Maximum cooling demand.

1.4 HYDRONIC SYSTEM CAPACITY TEST

.1 Timing: After:
.1 TAB has been completed
.2 Verification of operating, limit, safety controls.
.3 Verification of primary and secondary pump flow rates.

1.4 HYDRONIC SYSTEM CAPACITY TEST (Cont'd)

.1 Timing:(Cont'd)
.4 Verification of accuracy of temperature and pressure sensors and gauges.

.2 Calculate system capacity at test conditions.

.3 Using manufacturer's published data and calculated capacity at test conditions, extrapolate system capacity at design conditions.

.4 When capacity test is completed, return controls and equipment status to normal operating conditions.

1.5 HUMIDIFICATION SYSTEMS

.1 In addition to procedures specified above, perform following:
.1 Perform TAB as specified Section 23 05 93.

1.6 FUEL OIL SYSTEMS

.1 Notify authorities having jurisdiction to enable witnessing of tests as required.

1.7 WET AND DRY PIPE SPRINKLER SYSTEM, STANDPIPE AND HOSE SYSTEMS

.1 Cleaning, testing, start-up, performance verification of equipment, systems, components, and devices is specified elsewhere in Mechanical Division.

.2 Verification of controls, detection devices, alarm devices is specified Electrical Divisions.

.3 Demonstrate that fire hose will reach to most remote location regardless of partitions, obstructions, etc.

.4 Verify operation of interlocks between HVAC systems and fire alarm systems.

1.8 REPORTS

.1 In accordance with Section 01 91 00: Reports, supplemented as specified herein.

1.9 TRAINING .1 Training of O&M Personnel, supplemented as specified herein.

PART 2 - PRODUCTS

2.1 NOT USED .1 Not Used.

PART 3 - EXECUTION

3.1 NOT USED .1 Not Used.

END

PART 1 - GENERAL

1.1 RELATED SECTIONS

.1 Section 01 74 21 - Construction/Demolition Waste Management And Disposal.

.2 Section 23 25 00 - HVAC Water Treatment Systems.

.3 Section 23 05 93 - Testing Adjusting and Balancing for HVAC.

1.2 REFERENCES

.1 American Society for Testing and Materials
.1 ASTM E202-10, Standard Test Methods for Analysis of Ethylene Glycols and Propylene Glycols.

1.3 WASTE MANAGEMENT AND DISPOSAL

.1 Refer to Section 01 74 20.

PART 2 - PRODUCTS

2.1 CLEANING SOLUTIONS

.1 Tri-sodium phosphate: 0.40 kg per 100 L water in system.

.2 Sodium carbonate: 0.40 kg per 100 L water in system.

.3 Low-foaming detergent: 0.01 kg per 100 L water in system.

PART 3 - EXECUTION

3.1 CLEANING HYDRONIC AND STEAM SYSTEMS

.1 Timing
.1 Systems to be operational, hydrostatically tested and with safety devices functional, before cleaning is carried out.

.2 Cleaning Agency:
.1 Retain qualified water treatment specialist to perform system cleaning.

.3 Cleaning procedures:
.1 Provide detailed report outlining proposed cleaning procedures at least 4 weeks prior to proposed starting date. Report to include:
.1 Cleaning procedures, flow rates, elapsed time.
.2 Chemicals and concentrations to be used.
.3 Inhibitors and concentrations.
.4 Specific requirements for completion of work.
.5 Special precautions for protecting piping system materials and components.
.6 Complete analysis of water to be used to ensure water will not damage systems or equipment.

.4 Conditions at time of cleaning of systems
.1 Systems to be free from construction debris, dirt and other foreign material.
.2 Control valves to be operational, fully open to ensure that terminal units can be cleaned properly.
.3 Strainers to be clean prior to initial fill.
.4 Install temporary filters on pumps not equipped with permanent filters.
.5 Install pressure gauges on strainers to detect plugging.

.5 Report on Completion of Cleaning
.1 When cleaning is completed, submit report, complete with certificate of compliance with specifications of cleaning component supplier.

.6 Hydronic Systems:
.1 Fill system with water, ensure air is vented from system.
.2 Add chemicals under direct supervision of chemical treatment supplier.

3.1 CLEANING HYDRONIC AND STEAM SYSTEMS (Cont'd)

.6 Hydronic Systems:(Cont'd)

.3 Closed loop systems: circulate system cleaner at 60° C for at least 36 h. Drain as quickly as possible. Refill with water and inhibitors. Test concentrations and adjust to recommended levels.

.4 Flush velocity in system mains and branches so as to ensure removal of debris. System pumps may be used for circulating cleaning solution provided that velocities are adequate.

.5 Add chemical solution to system.

.6 Establish circulation, raise temperature slowly to maximum design 82° C minimum. Circulate for 12 h, ensuring flow in all circuits. Remove heat, continue to circulate until temperature is below 38° C. Drain as quickly as possible. Refill with clean water. Circulate for 6 h at design temperature. Drain and repeat procedures specified above. Flush through low point drains in system. Refill with clean water adding to sodium sulphite (test for residual sulphite).

.7 Steam Systems: In addition to general requirements as specified above, perform following:

.1 Remove internal components of steam traps until flushing and warm-up have been completed.

.2 Open drip points to atmosphere. If needed for protection of personnel or environment, install flexible hose and direct discharge to safe location.

.3 Starting at drip point closest to source, verify removal of condensate, then re-install steam trap internal parts. Repeat sequence down the line.

.4 Water hammer: Determine source and eliminate cause.

3.2 START-UP OF HYDRONIC SYSTEMS

.1 After cleaning is completed and system is filled:

.1 Establish circulation and expansion tank level, set pressure controls.

.2 Ensure air is removed.

.3 Check pumps to be free from air, debris, possibility of cavitation when system is at design temperature.

.4 Dismantle system pumps used for cleaning, inspect, replace worn parts, install new gaskets and new set of seals.

3.2 START-UP OF HYDRONIC SYSTEMS (Cont'd)

.1 (Cont'd)

.5 Clean out strainers repeatedly until system is clean.

.6 Commission water treatment systems as specified in Section 23 25 00.

.7 Check water level in expansion tank with cold water with circulating pumps OFF and again with pumps ON.

.8 Repeat with water at design temperature.

.9 Check pressurization to ensure proper operation and to prevent water hammer, flashing, cavitation. Eliminate water hammer and other noises.

.10 Bring system up to design temperature and pressure slowly over a 48 hour period.

.11 Perform TAB as specified in Section 23 05 93.

.12 Adjust pipe supports, hangers, springs as necessary.

.13 Monitor pipe movement, performance of expansion joints, loops, guides, anchors.

.14 If sliding type expansion joints bind or if bellows type expansion joints flex incorrectly, shut down system, re-align, repeat start-up procedures.

.15 Re-tighten bolts, etc. using torque wrench, to compensate for heat-caused relaxation. Repeat several times during commissioning.

.16 Check operation of drain valves.

.17 Adjust valve stem packings as systems settle down.

.18 Fully open all balancing valves (except those that are factory-set).

.19 Check operation of over-temperature protection devices on circulating pumps.

.20 Adjust alignment of piping at pumps to ensure flexibility, adequacy of pipe movement, absence of noise or vibration transmission.

END

PART 1 - GENERAL

1.1 SUMMARY

.1 Section Includes:
.1 Copper piping valves and fittings for hydronic systems.

1.2 REFERENCES

.1 American National Standards Institute (ANSI)/American Welding Society (AWS)
.1 ANSI/AWS A5.8/A5.8M-2011, Specification Filler Metals for Brazing and Bronze Welding.

.2 American Society of Mechanical Engineers (ASME)
.1 ANSI/ASME B16.4-2006, Gray Iron Threaded Fittings.
.2 ANSI/ASME B16.15-2006, Cast Bronze Threaded Fittings.
.3 ANSI B16.18-2001(R2005), Cast Copper Alloy, Solder Joint Pressure Fittings.
.4 ANSI/ASME B16.22-2001(R2005), Wrought Copper and Copper-Alloy Solder Joint Pressure Fittings.

.3 American Society for Testing and Materials International (ASTM)
.1 ASTM B32-08, Standard Specification for Solder Metal.
.2 ASTM B61-08, Standard Specification for Steam or Valve Bronze Castings.
.3 ASTM B62-09, Standard Specification for Composition Bronze or Ounce Metal Castings.
.4 ASTM B88M-05, Standard Specification for Seamless Copper Water Tube Metric.

.4 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
.1 Material Safety Data Sheets (MSDS).

.5 Manufacturers Standardization Society (MSS)
.1 MSS SP-67-2002a, Butterfly Valves.
.2 MSS SP-70-2006, Gray Iron Gate Valves, Flanged and Threaded Ends.
.3 MSS SP-71-2005, Gray Iron Swing Check Valves, Flanged and Threaded Ends.
.4 MSS SP-80-2008, Bronze Gate, Globe, Angle and Check Valves.
.5 MSS SP-85-2002, Cast Iron Globe and Angle Valves, Flanged and Threaded Ends.

1.3 SUBMITTALS

.1 Product Data:
.1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 33 00. Include product characteristics, performance criteria, and limitations.

.2 Shop Drawings:
.1 Submit shop drawings in accordance with Section 01 33 00.
.1 Shop drawings: submit drawings
.2 Indicate on manufacturers catalogue literature the following: VALVES.

.3 Quality assurance submittals: submit following in accordance with Section 01 33 00.

.4 Closeout Submittals:
.1 Provide maintenance data for incorporation into manual specified in Section 01 78 00.

1.4 QUALITY ASSURANCE

.1 Regulatory Requirements: ensure Work is performed in compliance with CEPA, CEAA, TDGA, and applicable Provincial /Territorial regulations.

.2 Health and Safety:
.1 Do construction occupational health and safety in accordance with Section 01 35 29.

1.5 DELIVERY, STORAGE, AND HANDLING

.1 Packing, shipping, handling and unloading:
.1 Deliver, store and handle in accordance with manufacturer's written instructions and Section 01 61 00.

PART 2 - PRODUCTS

2.1 PIPE

.1 Type L copper tubing: to ASTM B88M, minimum 64% recycled content.

.2 Type "L" hard drawn copper tubing conforming to ASTM B88. Type "L" soft annealed copper tubing may be used within convector/fan coil enclosures.

.3 Type "K" soft annealed copper tubing conforming to ASTM B88 with no joints permitted below the

2.1 PIPE (Cont'd)

.3 (Cont'd)
floor for below grade applications. Use approved tube bender for tube bending.

2.2 FITTINGS

.1 Cast bronze threaded fittings: to ANSI/ASME B16.15.

.2 Wrought copper and copper alloy solder joint pressure fittings: to ANSI/ASME B16.22, minimum 64% recycled content.

.3 Cast iron threaded fittings: to ANSI/ASME B16.4, minimum 25% recycled content.

.4 Cast copper alloy solder joint pressure fittings: to ANSI B16.18, minimum 64% recycled content.

2.3 FLANGES

.1 Brass or bronze: threaded.

.2 Cast iron: threaded.

2.4 JOINTS

.1 Solder, tin-antimony, 95:5: to ASTM B32.

.2 Silver solder BCUP: to ANSI/AWS A5.8.

.3 Brazing: as indicated.

2.5 VALVES

.1 Connections:
.1 NPS 2 and smaller: ends for soldering.
.2 NPS 2 1/2 and larger: flanged or grooved ends.

.2 Gate Valves Application: isolating equipment, control valves, pipelines:
.1 NPS 2 and under:
.1 Mechanical Rooms: Class 125, rising stem split wedge disc, as specified Section 23 05 23.01.
.2 Elsewhere: Class 125, non- rising stem, solid wedge disc, as specified Section 23 05 23.01.
.2 NPS 2 1/2 and over:
.1 Mechanical Rooms: rising stem, split wedge disc, bronze trim, as specified Section 23 05 23.02.

2.5 VALVES (Cont'd)

.3 Butterfly valves: application: isolating each cell or section of multiple component equipment (eg. multi-section coils):
.1 NPS 2 1/2 and over: lug type grooved ends: as specified Section 23 05 17.

.4 Globe valves: application: throttling, flow control, emergency bypass:
.1 NPS 2 and under:
.1 Mechanical Rooms: withPFTE disc, as specified Section 23 05 23.01.
.2 Elsewhere: globe, with composition disc, as specified Section 23 05 23.01.
.2 NPS 2 1/2 and over:
.1 With composition bronze disc, bronze trim, as specified Section 23 05 23.02.

.5 Balancing, for TAB:
.1 Sizes: calibrated balancing valves, as specified.
.2 NPS 2 and under:
.1 Mechanical Rooms: globe, with plug disc as specified Section 23 05 23.01.
.2 Elsewhere: globe, with plug disc as specified Section 23 05 23.01.

.6 Drain valves: gate, Class 125, non-rising stem, solid wedge disc, as specified Section 23 05 23.01.

.7 Bypass valves on gate globe valves NPS 8 and larger: NPS 3/4, globe, with PFTE disc as specified Section 23 05 23.01.

.8 Swing check valves:
.1 NPS 2 and under:
.1 Class 125, swing, with composition disc, as specified Section 23 05 23.01.
.2 NPS 2 1/2 and over:
.1 Flanged Grooved ends: as specified Section 23 05 23.02.

.9 Silent check valves:
.1 NPS 2 and under:
.1 As specified Section 23 05 23.01.
.2 NPS 2 1/2 and over:
.1 Flanged Grooved ends: as specified Section 23 05 23.02.

.10 Ball valves:
.1 NPS 2 and under: as specified Section 23 05 23.01.

PART 3 - EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 PIPING INSTALLATION

.1 Connect to equipment in accordance with manufacturer's instruction unless otherwise indicated.

.2 Install concealed pipes close to building structure to keep furring space to minimum. Install to conserve headroom and space. Run exposed piping parallel to walls. Group piping where ever practical.

.3 Slope piping in direction of drainage and for positive venting.

.4 Use eccentric reducers at pipe size change installed to provide positive drainage or positive venting.

.5 Provide clearance for installation of insulation and access for maintenance of equipment, valves and fittings.

.6 Assemble piping using fittings manufactured to ANSI standards.

3.3 VALVE INSTALLATION

.1 Install rising stem valves in upright position with stem above horizontal.

.2 Install butterfly valves on chilled water only.

.3 Install ball or butterfly valves at branch take-offs and to isolate each piece of equipment, and as indicated.

.4 Install globe valves for balancing and in by-pass around control valves as indicated.

.5 Install silent check valves on discharge of pumps and in vertical pipes with downward flow and as indicated.

3.3 VALVE INSTALLATION (Cont'd)

.6 Install swing check valves in horizontal lines on discharge of pumps and as indicated.

.7 Install chain operators on valves NPS 2 1/2 and over where installed more than 2400 mm above floor in Mechanical Equipment Rooms.

.8 Install plug cocks or ball valves for glycol service.

3.4 CIRCUIT BALANCING VALVES

.1 Install flow measuring stations and flow balancing valves as indicated.

.2 Remove handwheel after installation and TAB is complete.

.3 Tape joints in prefabricated insulation on valves installed in chilled water mains.

3.5 FLUSHING AND CLEANING

.1 Flush and clean in presence of Departmental Representative.

.2 Flush after pressure test for a minimum of 4h.

.3 Fill with solution of water and non-foaming, phosphate-free detergent 3% solution by weight. Circulate for minimum of 8h.

.4 Refill system with clean water. Circulate for at least 4h. Clean out strainer screens/baskets regularly. Then drain.

.5 Refill system with clean water. Circulate for at least 2h. Clean out strainer screens/baskets regularly. Then drain.

.6 Drainage to include drain valves, dirt pockets, strainers, low points in system.

.7 Re-install strainer screens/baskets only after obtaining Departmental Representative's approval.

3.6 FILLING OF SYSTEM

.1 Refill system with clean water adding water treatment.

3.7 FIELD QUALITY CONTROL

.1 Testing:

.1 Test system in accordance with Section 21 05 01.

.2 Balancing:

.1 Balance water systems to within plus or minus 5 % of design output.

.2 Refer to Section for applicable procedures.

END

PART 1 - GENERAL

1.1 REFERENCES

.1 American National Standards Institute/American Water Works Association (ANSI/AWWA)
.1 ANSI/AWWA C111/A21.11-12, Standard for Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.

.2 American Society of Mechanical Engineers (ASME)
.1 ASME B16.1-10,Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250.
.2 ASME B16.3-11, Malleable Iron Threaded Fittings: Classes 150 and 300.
.3 ASME B16.5-09, Pipe Flanges and Flanged Fittings: NPS ½ through NPS 24 Metric/Inch Standard.
.4 ASME B16.9-07, Factory-Made Wrought Buttwelding Fittings.
.5 ASME B18.2.1-10, Square Hex, Heavy Hex and Askew Head Bolts and Hex, Heavy Hex, Hex Flange. Loded Head and Lag Screws (Inch Series).
.6 ASME B18.2.2-10, Nuts for General Applications: Machine Screw Nuts, Hex, Square, Hex Flange, and Coupling Nuts (Inch Series).

.3 ASTM International
.1 ASTM A47/A47M-99(2009), Standard Specification for Ferritic Malleable Iron Castings.
.2 ASTM A53/A53M-10, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc Coated Welded and Seamless.
.3 ASTM A536-84(2009), Standard Specification for Ductile Iron Castings.
.4 ASTM B61-08, Standard Specification for Steam or Valve Bronze Castings.
.5 ASTM B62-09, Standard Specification for Composition Bronze or Ounce Metal Castings.

.4 CSA International
.1 CSA B242-05(R2011), Groove and Shoulder Type Mechanical Pipe Couplings.
.2 CSA W48-06, Filler Metals and Allied Materials for Metal Arc Welding.

.5 Manufacturer's Standardization of the Valve and Fittings Industry (MSS)
.1 MSS-SP-67-2002a, Butterfly Valves.
.2 MSS-SP-70-06, Gray Iron Gate Valves, Flanged and Threaded Ends.
.3 MSS-SP-71-05, Gray Iron Swing Check Valves Flanged and Threaded Ends.

1.1 REFERENCES (Cont'd)

.5 (Cont'd)
.4 MSS-SP-80-08, Bronze Gate, Globe, Angle and Check Valves.
.5 MSS-SP-85-02, Gray Iron Globe and Angle Valves, Flanged and Threaded Ends.

1.2 ACTION AND INFORMATIONAL

.1 Submit in accordance with Section 01 33 00.

SUBMITTALS

.2 Product Data:
.1 Submit manufacturer's instructions, printed product literature and data sheets for hydronic systems and include product characteristics, performance criteria, physical size, finish and limitations.

1.3 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00.

1.4 DELIVERY, STORAGE AND HANDLING

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

.2 Refer to Section 01 74 20.

PART 2 - PRODUCTS

2.1 PIPE

.1 Steel pipe: to ASTM A53/A53M, Grade B, as follows:
.1 To NPS 6: Schedule 40.

2.2 PIPE JOINTS

.1 NPS 2 and under: screwed fittings with PTFE tape or lead-free pipe dope.

.2 NPS 2-1/2 and over: welding fittings and flanges to CSA W48.

.3 Roll grooved: standard rigid coupling to CSA B242.

2.2 PIPE JOINTS (Cont'd)

.4 Flanges: plain or raised face, slip-on weld neck to ANSI/AWWA C111/A21.11.

.5 Flange gaskets: to ANSI/AWWA C111/A21.11.

.6 Pipe thread: taper.

.7 Bolts and nuts: to ASME B18.2.1 and ASME B18.2.2.

.8 Roll grooved coupling gaskets: type EPDM.

2.3 FITTINGS

.1 Screwed fittings: malleable iron, to ASME B16.3, Class 150.

.2 Pipe flanges and flanged fittings:
.1 Cast iron: to ASME B16.1, Class 125.
.2 Steel: to ASME B16.5.

.3 Butt-welding fittings: steel, to ASME B16.9.

.4 Unions: malleable iron, to ASTM A47/A47M and ASME B16.3.

.5 Fittings for roll grooved piping: malleable iron to ASTM A47/A47M ductile iron to ASTM A536.

2.4 VALVES

.1 Connections:
.1 NPS 2 and smaller: screwed ends.
.2 NPS 2-1/2 and larger: flanged or grooved ends.

.2 Gate valves: to MSS-SP-70 to MSS-SP-80 application: isolating equipment, control valves, pipelines:
.1 NPS 2 and under:
.1 Mechanical Rooms: Class 125, rising stem, split wedge disc, as specified Section 23 05 23.01.
.2 Elsewhere: Class 125, non- rising stem, solid wedge disc, as specified Section 23 05 23.01.
.2 NPS 2-1/2 and over:
.1 Mechanical Rooms: rising stem, split wedge disc, lead free bronze trim, as specified Section 23 05 23.02.
.1 Operators: chain manual gear.
.2 Elsewhere: non- rising stem, solid wedge disc, lead free bronze trim, as specified Section 23 05 23.02.

2.4 VALVES (Cont'd)

.3 Butterfly valves: to MSS-SP-67 application: isolating cells or section of multiple component equipment (i.e. multi-section coils, multi-cell cooling towers):
.1 NPS 2-1/2 and over: lug type grooved ends: as specified Section 23 05 17.

.4 Globe valves: to MSS-SP- 80 85 application: throttling, flow control, emergency bypass:
.1 NPS 2 and under:
.1 Mechanical Rooms: withPTFE disc, as specified Section 23 05 23.01.
.2 Elsewhere: globe, with composition disc, as specified in Section 23 05 23.01
.2 NPS 2-1/2 and over:
.1 With composition lead free bronze disc, lead free bronze trim, as specified Section 23 05 23.02.

.5 Balancing, for TAB:
.1 Sizes: calibrated balancing valves, as specified this section.
.2 NPS 2 and under:
.1 Mechanical Rooms: globe, with plug disc as specified Section 23 05 23.01.
.2 Elsewhere: globe, with plug disc as specified Section 23 05 23.01.

.6 Drain valves: Gate, Class 125, non-rising stem, solid wedge disc, as specified Section 23 05 23.01.

.7 Bypass valves on gate glove valves NPS 8 and larger: NPS 3/4, Globe, with PTFE disc as specified Section 23 05 23.01.

.8 Swing check valves: to MSS-SP-71.
.1 NPS 2 and under:
.1 Class 125, swing, with composition disc, as specified Section 23 05 23.01.
.2 NPS 2-1/2 and over:
.1 Flanged Grooved ends: as specified Section 23 05 23.02.

.9 Silent check valves:
.1 NPS 2 and under:
.1 As specified Section 23 05 23.01.
.2 NPS 2-1/2 and over:
.1 Flanged Grooved ends: as specified Section 23 05 23.02.

.10 Ball valves:
.1 NPS 2 and under: as specified Section 23 05 23.01.

PART 3 - EXECUTION

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for hydronic systems installation in accordance with manufacturer's written instructions.
.1 Visually inspect substrate in presence of Departmental Representative.
.2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 PIPING INSTALLATION

.1 Install pipework in accordance with Section 23 05 05.

3.3 CIRCUIT BALANCING VALVES

.1 Install flow measuring stations and flow balancing valves as indicated.

.2 Remove handwheel after installation and when TAB is complete.

.3 Tape joints in prefabricated insulation on valves installed in chilled water mains.

3.4 CLEANING, FLUSHING AND START-UP

.1 In accordance with Section 23 08 02.

3.5 TESTING

.1 Test system in accordance with Section 21 05 01.

3.6 BALANCING

.1 Balance water systems to within plus or minus 5% of design output.

.2 In accordance with Section 23 05 93 for applicable procedures.

3.7 PERFORMANCE VERIFICATION

.1 In accordance with Section 23 08 01.

3.8 CLEANING

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

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

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

3.9 PROTECTION

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

.2 Repair damage to adjacent materials caused by hydronic systems installation.

END

PART 1 - GENERAL

1.1 REFERENCES

.1 American Society of Mechanical Engineers (ASME)
.1 ASME-04(2007), Boiler and Pressure Vessel Code.

.2 ASTM International Inc.
.1 ASTM B62-09, Standard Specification for Composition Bronze or Ounce Metal Castings.

.3 Canadian Standards Association (CSA International)
.1 CSA B51-09, Boiler, Pressure Vessel, and Pressure Piping Code.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Provide submittals in accordance with Section 01 11 00.

.2 Product Data:
.1 Provide manufacturer's printed product literature and datasheets for expansion tanks, air vents, separators, valves, and strainers, and include product characteristics, performance criteria, physical size, finish and limitations.

1.3 CLOSEOUT SUBMITTALS

.1 Submit maintenance and operation data in accordance with Section 01 33 00.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle in accordance with Section 01 61 00.

PART 2 - PRODUCTS

2.1 PIPE LINE STRAINER

.1 NPS 1/2 to 2: bronze body to ASTM B62, solder end screwed connections, Y pattern.

.2 Working pressure: 860 kPa.

.3 NPS 2 1/2 to 12: cast steel body to ASTM A278/A278M, flanged connections.

.4 NPS 2 to 12: T type with ductile iron body to ASTM A536 grooved ends.

.5 Blowdown connection NPS 1.

.6 Screen: stainless steel with 1.19 mm perforations.

.7 Working pressure: 860 kPa.

2.2 SUCTION DIFFUSER

.1 Body: cast iron with flanged screwed connections.

.2 Strainer: with built-in, disposable 1.19 mm mesh, low pressure drop screen and NPS 1 blowdown connection.

.3 Permanent magnet particle trap.

.4 Full length straightening vanes.

.5 Pressure gauge tappings.

.6 Adjustable support leg.

PART 3 - EXECUTION

3.1 APPLICATION

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

3.2 GENERAL

.1 Maintain adequate clearance to permit service and maintenance.

3.3 STRAINERS

.1 Install in horizontal or down flow lines.

.2 Ensure clearance for removal of basket.

.3 Install lockshield type valve at inlet to tank.

3.4 SUCTION DIFFUSERS

.1 Install on inlet to pumps having suction size greater than 50.

END

PART 1 - GENERAL

1.1 REFERENCES

.1 American Society of Heating Refrigeration and Air-Conditioning Engineers (ASHRAE)
.1 Standard 90.1-2010, Energy Standard for Buildings Except Low-Rise Residential Buildings.

.2 Electrical Equipment Manufacturers Advisory Council (EEMAC)

.3 Canadian Standards Association (CSA International)
.1 CSA-B214-07, Installation Code for Hydronic Heating Systems.

.4 National Electrical Manufacturers' Association (NEMA)
.1 NEMA MG 1-2006, Motors and Generators.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00.

.2 Product Data:
.1 Provide manufacturer's printed product literature and datasheets for pump, circulator, and equipment, and include product characteristics, performance criteria, physical size, finish and limitations indicate point of operation, and final location in field assembly.

1.3 CLOSEOUT SUBMITTALS

.1 Provide maintenance and operation data for incorporation into manual specified in Section 01 78 00.

1.4 MAINTENANCE

.1 Provide maintenance materials in accordance with Section 01 78 00.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle in accordance with Section 01 61 00.

.2 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.

1.5 DELIVERY, STORAGE AND HANDLING (Cont'd)

.3 Refer to Section 01 74 20.

PART 2 - PRODUCTS

2.1 IN-LINE CIRCULATORS

.1 Volute: cast iron radially split, with screwed or flanged design suction and discharge connections.

.2 Impeller: cast bronze.

.3 Shaft: alloy steel with bronze sleeve bearing, integral thrust collar.

.4 Seal assembly: mechanical for service to 135 °C.

.5 Coupling: flexible self-aligning.

.6 Motor: to NEMA MG 1 resilient mounted, drip proof, sleeve bearing, efficiency.

.6 Premium as per Section 23 05 14.

.7 Capacity: as indicated.

.8 Design pressure: 860 kPa.

2.2 VERTICAL IN-LINE CIRCULATORS

.1 Volute: cast iron radially split, with tapped openings for venting, draining and gauge connections, with screwed or flanged suction and discharge connections.

.2 Impeller: brass or bronze.

.3 Shaft: alloy steel with bronze sleeve bearing, integral thrust collar.

.4 Seal assembly: mechanical for service to 135 °C.

.5 Coupling: flexible rigid self-aligning.

.6 Motor: to NEMA MG 1 resilient mounted, drip proof, sleeve bearing.

2.2 VERTICAL IN-LINE CIRCULATORS (Cont'd)

.7 Capacity: as indicated.

.8 Design pressure: 1200 kPa.

2.3 SINGLE SUCTION CENTRIFUGAL PUMP

.1 General: bronze fitted all iron pump complete with motor.

.2 Base: common cast iron with drip rim and tapping for drain connection.

.3 Volute: cast iron radially split, end suction, flanged suction and discharge, with drain plug and vent cock, suction and discharge pressure gauge tappings.

.4 Impeller: bronze enclosed type, keyed drive with locking nut or screw.

.5 Shaft: stainless steel with two point support, sleeve bearings.

.6 Seal assembly: on mechanical seal, grease lubricated.

.7 Coupling: flexible self-aligning.

.8 Motor: As per section.

.9 Capacity: as indicated.

.10 Design pressure: 1200 kPa.

PART 3 - EXECUTION

3.1 APPLICATION

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

3.2 INSTALLATION

.1 Install hydronic pumps to: CSA-B214.

3.2 INSTALLATION (Cont'd)

.2 In line circulators: install as indicated by flow arrows.
.1 Support at inlet and outlet flanges or unions.
.2 Install with bearing lubrication points accessible.

.3 Base mounted type: supply templates for anchor bolt placement.
.1 Include anchor bolts with sleeves. Place level, shim unit and grout.
.2 Align coupling in accordance with manufacturer's recommended tolerance.
.3 Check oil level and lubricate.

.4 Ensure that pump body does not support piping or equipment.
.1 Provide stanchions or hangers for this purpose.
.2 Refer to manufacturer's installation instructions for details.

.5 Pipe drain tapping to floor drain.

.6 Install volute venting pet cock in accessible location.

.7 Check rotation prior to start-up.

.8 Install pressure gauge test cocks.

3.3 START-UP

.1 General:
.1 In accordance with Section 01 91 13: General Requirements; supplementd as specified herein.
.2 In accordance with manufacturer's recommendations.

.2 Procedures:
.1 Before starting pump, check that cooling water system over-temperature and other protective devices are installed and operative.
.2 After starting pump, check for proper, safe operation.
.3 Check installation, operation of mechanical seals, packing gland type seals. Adjust as necessary.
.4 Check base for free-floating, no obstructions under base.
.5 Run-in pumps for 12 continuous hours minimum.

3.3 START-UP (Cont'd)

.2 Procedures:(Cont'd)

.6 Verify operation of over-temperature and other protective devices under low- and no-flow condition.

.7 Eliminate air from scroll casing.

.8 Adjust water flow rate through water-cooled bearings.

.9 Adjust flow rate from pump shaft stuffing boxes to manufacturer's recommendation.

.10 Adjust alignment of piping and conduit to ensure true flexibility.

.11 Eliminate cavitation, flashing and air entrainment.

.12 Adjust pump shaft seals, stuffing boxes, glands.

.13 Measure pressure drop across strainer when clean and with flow rates as finally set.

.14 Replace seals if pump used to degrease system or if pump used for temporary heat.

.15 Verify lubricating oil levels.

3.4 PERFORMANCE VERIFICATION (PV)

.1 General:

.1 Verify performance in accordance with Section 01 91 13: General Requirements, supplemented as specified herein.

.2 Verify that manufacturer's performance curves are accurate.

.2 Ensure valves on pump suction and discharge provide tight shut-off.

.3 Mark points of design and actual performance at design conditions as finally set upon completion of TAB.

.4 Commissioning Reports: in accordance with Section 01 91 00 reports

3.5 CLEANING

.1 Clean in accordance with Section 01 74 11.

.1 Remove surplus materials, excess materials, rubbish, tools and equipment.

END

PART 1 - GENERAL

1.1 REFERENCES

.1 American National Standards Institute (ANSI) / American Society of Mechanical Engineers (ASME)
.1 ASME B16.1-05, Cast Iron Pipe Flanges and Flanged Fittings: Class 25, 125, 250 and 800.
.2 ASME B16.25-07, Buttwelding Ends.
.3 ASME B16.3-11, Malleable Iron Threaded Fittings: Classes 150 and 300.
.4 ANSI/ASME B16.5-09, Pipe Flanges and Flanged Fittings: NPS ½ through 24.
.5 ANSI/ASME B16.9-07, Factory-Made Wrought Steel Buttwelding Fittings.
.6 ASME B18.2.1-2010),Square, Hex, Heavy Hex, and Askew Head Bolts and Hex, Heavy Hex, Hex Flange, Lobed Head, and Lag Screws (Inch Series).
.7 ASME B18.2.2-2010, Nuts for General Applications: Machine Screw Nuts, Hex, Square, Hex Flange, and Coupling Nuts (Inch Series).

.2 American National Standards Institute (ANSI) / American Water Works Association (AWWA)
.1 ANSI/AWWA C111/A21.11-12, Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.

.3 ASTM International Inc.
.1 ASTM A47/A47M-99(2009), Standard Specification for Ferritic Malleable Iron Castings.
.2 ASTM A53/A53M-10, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc Coated, Welded and Seamless.
.3 ASTM A126-04(2009), Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings.

.4 Canadian Standards Association (CSA International)
.1 CSA W48-06, Filler Metals and Allied Materials for Metal Arc Welding.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00.

.2 Product Data:
.1 Provide manufacturer's printed product literature and datasheets for valves and pipes

1.2 ACTION AND INFORMATIONAL SUBMITTALS (Cont'd)

.2 Product Data:(Cont'd)
.1 (Cont'd)
and include product characteristics, performance criteria, physical size, finish and limitations.

1.3 CLOSEOUT SUBMITTALS

.1 Provide operation and maintenance data for incorporation into manual specified in Section 01 78 00.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle in accordance with Section 01 61 00.

.2 Packaging Waste Management: Refer to Section 01 74 20.

PART 2 - PRODUCTS

2.1 PIPE

.1 Steel pipe: to ASTM A53/A53M, Grade B, as follows:
.1 Steam;
.1 Schedule 40.
.2 Condensate: Schedule 80. Piping down stream of humidifier traps shall be stainless steel.

2.2 PIPE JOINTS

.1 NPS 2 and under: screwed fittings with PTFE tape or lead-free dope.

.2 Pipe thread: taper.

2.3 FITTINGS

.1 Screwed fittings: malleable iron to ASME B16.3, Class 150.

.2 Unions: malleable iron, to ASTM A47/A47M and ASME B16.3.

2.4 VALVES

.1 Connections:
.1 NPS 2 and smaller: screwed ends.

.2 Valves: Ball valves, Class 125, as specified Section 23 05 23.01.

PART 3 - EXECUTION

3.1 APPLICATION

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

3.2 PIPING

.1 Install pipework in accordance with Section 23 05 01, supplemented as specified below.

.2 Connect branch lines into top of mains.

.3 Install piping in direction of flow with slopes as follows, unless indicated:
- .1 Steam: 1:240.
- .2 Condensate return: 1:70.

.4 Make provision for thermal expansion as indicated.

.5 Drip pocket: line size.

3.3 SYSTEM START-UP

.1 In accordance with Section 23 08 02.

3.4 PERFORMANCE VERIFICATION (PV)

.1 General:
- .1 Verify performance in accordance with Section 23 08 01 supplemented as specified herein.

.2 Timing, only after:
- .1 Pressure tests successfully completed.
- .2 Flushing as specified has been completed.
- .3 Water treatment system has been commissioned.

.3 PV Procedures:
- .1 Verify proper operation of system components, including, but not limited to:
  - .1 Steam traps - verify no blow-by.

.4 Humidifiers: for commissioning procedures, refer to Section 23 84 13.

3.5 CLEANING .1 Clean in accordance with Section 01 74 11.

END

PART 1 - GENERAL

1.1 REFERENCES

.1 American Society for Mechanical Engineers (ASME International)

.2 ASTM International Inc.
.1 ASTM A126-04(2009), Standard Specification for Gray Iron Castings for Valves, Flanges and Pipe Fittings.
.2 ASTM A167-99(2009), Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet and Strip.
.3 ASTM A216/A216M-08, Standard Specification for Steel Castings, Carbon, Suitable for Fusion Welding for High-Temperature Service.
.4 ASTM A240/A240M-10a, Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.
.5 ASTM A276-10, Standard Specification for Stainless Steel Bars and Shapes.
.6 ASTM A278/A278M-01(2006), Standard Specification for Gray Iron Castings for Pressure - Containing Parts for Temperatures up to 650 Degrees F (350 degrees C).
.7 ASTM A351/A351M-10, Standard Specification for Castings, Austenitic, for Pressure-Containing Parts.
.8 ASTM A564/A564M-10, Standard Specification for Hot-Rolled and Cold-Finished Age-Hardening Stainless Steel Bars and Shapes.
.9 ASTM B62-09, Standard Specification for Composition Bronze or Ounce Metal Castings.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00.

.2 Product Data:
.1 Provide manufacturer's printed product literature Canadian Registration Number (CRN), and datasheets for steam traps, vacuum breakers, pressure reducing valves, air vents, safety relief valves, and include product characteristics, performance criteria, physical size, finish and limitations.
.2 Provide two copies WHMIS MSDS - Material Safety Data Sheets.

1.2 ACTION AND INFORMATIONAL SUBMITTALS (Cont'd)

.3 Closeout Submittals:
.1 Provide maintenance data for incorporation into manual specified in Section 01 78 00 and include following:.

1.3 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle in accordance with Section 01 61 00.

.2 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.

PART 2 - PRODUCTS

2.1 MATERIALS

.1 Stainless steel: to ASTM A351/A351M.

2.2 FLOAT AND THERMOSTATIC STEAM TRAPS 0-110 kPa

.1 Application: as indicated.

.2 Materials: stainless steel.

.3 Capacity: as indicated.

2.3 INVERTED BUCKET STEAM TRAP 2-1000.4 kPa

.1 Application: for end of line drips humidifiers as indicated.

.1 Materials: stainless steel.

.2 Capacity: as indicated.

2.5 PIPE LINE STRAINERS UP TO NPS

.1 Application: as indicated.

.2 Working pressure: 860 kPa.

.3 Body: stainless steel.

.4 Connections: screwed.

.5 Screen: stainless steel with 0.8 mm perforations.

PART 3 - EXECUTION

3.1 APPLICATION

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

.2 Maintain proper clearance around equipment to permit maintenance.

3.2 STRAINERS

.1 Install as indicated.

.2 Ensure clearance for removal of basket.

3.3 STEAM TRAPS

.1 Install unions on inlet and outlet.

END

PART 1 - GENERAL

1.1 REFERENCES

.1 American Society of Mechanical Engineers (ASME)
  .1 ASME Boiler and Pressure Vessel Code, Section VII-2010.

1.2 SHOP DRAWINGS

.1 Submit shop drawings in accordance with Section 01 33 00.

1.3 CLOSEOUT SUBMITTALS

.1 Submit operation and maintenance data for incorporation into manual specified in Section 01 78 00.

.2 Include following:
  .1 Log sheets as recommended by manufacturer.

1.4 WASTE MANAGEMENT AND DISPOSAL

.1 Refer to Section 01 74 20.

PART 2 - PRODUCTS

2.1 MANUFACTURER

.1 Equipment, chemicals, service by one supplier.

2.2 CHEMICAL FEED PIPING

.1 Resistant to chemicals employed. Pressure rating: kPa.

2.3 CHEMICALS

.1 Re-fill existing systems being replaced.

.2 Chemicals provided shall be compatible with existing system.

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Provide additional pump and circulators to carry out flushing and cleaning work carried out in this contract.

3.2 CLEANING OF MECHANICAL SYSTEM

.1 Provide copy of recommended cleaning procedures and chemicals for approval by Departmental Representative.

.2 Thoroughly flush mechanical systems installed under this contract.

.3 During circulation of cleaning solution, periodically examine and clean filters and screens and monitor changes in pressure drop across equipment.

.4 Drain and flush systems until alkalinity of rinse water is equal to make-up water. Refill with clean water treated to prevent scale and corrosion during system operation.

.5 Disposal of cleaning solutions to be approved by authority having jurisdiction.

.6 Do not connect to existing system without prior approval from Departmental Representative.

3.3 WATER TREATMENT SERVICES

.1 Service to include:

.1 Initial water analysis and treatment recommendations.
.2 System start-up assistance.

3.4 START-UP

.1 Start up water treatment systems in accordance with manufacturer's instructions.

3.5 COMMISSIONING

.1 Commissioning Agency: To be installing water treatment sub-contractor and/or mechanical contractor.

3.5 COMMISSIONING (Cont'd)

.2 Timing:
.1 After start-up deficiencies rectified.
.2 After start-up and before TAB of connected systems.

.3 Pre-commissioning Inspections:
.1 Verify:
.1 Presence of test equipment, reagents, chemicals, details of specific tests to be performed, operating instructions.
.2 Suitability of log book.
.3 Currency and accuracy of raw initial water analysis.
.4 Required quality of treated water.

.4 Certificates:
.1 Upon completion, furnish certificates confirming satisfactory installation and performance.

.5 Commissioning Reports:
.1 To include system schematics, test results, test certificates, raw and treated water analyses, design criteria, other data required by Departmental Representative.

END

PART 1 - GENERAL

1.1 SUMMARY

.1 Section Includes:
.1 Materials and installation of low-pressure metallic ductwork, joints and accessories.

1.2 REFERENCES

.1 American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. (ASHRAE).

.2 ASTM International.
.1 ASTM A635/A635M-09b, Standard Specification for Steel, Sheet and Strip, Heavy-Thickness Coils, Carbon, Hot Rolled.
.2 ASTM A653/A653M-11, Standard Specification for Steel Sheet, Zinc Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvannealed) by the Hot-Dip Process.

.3 Department of Justice Canada (Jus).
.1 Canadian Environmental Protection Act (CEPA), 1999, c. 33 .

.4 Health Canada/Workplace Hazardous Materials Information System (WHMIS).
.1 Material Safety Data Sheets (MSDS).

.5 National Fire Protection Association (NFPA).
.1 NFPA 90A-2012, Standard for the Installation of Air-Conditioning and Ventilating Systems.
.2 NFPA 90B-2012, Standard for the Installation of Warm Air Heating and Air-Conditioning Systems.
.3 NFPA 96-2011, Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations.

.6 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA).
.1 SMACNA HVAC Duct Construction Standards - Metal and Flexible, 3rd Edition 2005.
.2 SMACNA HVAC Air Duct Leakage Test Manual, 1985, 1st Edition.
.3 SMACNA IAQ Guidelines for Occupied Buildings Under Construction 2nd edition 2007; ANSI/SMACNA 008-2008.

.7 Transport Canada (TC).
.1 Transportation of Dangerous Goods Act (TDGA), 1992, c. 34.

1.3 SUBMITTALS

.1 Submit shop drawings and product data in accordance with Section 01 33 00.

.2 Product Data: submit WHMIS MSDS - Material Safety Data Sheets for the following:
.1 Sealants.
.2 Tape.
.3 Proprietary Joints.

1.4 QUALITY ASSURANCE

.1 Certification of Ratings:
.1 Catalogue or published ratings shall be those obtained from tests carried out by manufacturer or independent testing agency signifying adherence to codes and standards.

.2 Health and Safety:
.1 Do construction occupational health and safety in accordance with Section 01 35 29.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Refer to Section 01 74 20.

PART 2 - PRODUCTS

2.1 SEAL CLASSIFICATION

.1 Classification as follows:

TABLE PRESSURE CLASSIFICATION

Ductwork	Operating Pressure	Seal Classification	Remarks
Supply Air Ductwork Upstream of VAV Boxes	Up to 500 Pa	B	
Supply Air Downstream of VAV Boxes	250 Pa	C	
Return Air Ductwork	Up to -250 Pa	C	

2.1 SEAL .1 (Cont'd)

Exhaust and Outside Air Intake Plenums	Up to +/- 250 Pa	B
All Other Ductwork Not Listed Above	Up to 0.5" wg (125 Pa)	C

.2 Seal classification:
.1 Class A: longitudinal seams, transverse joints, duct wall penetrations and connections made airtight with sealant and tape.
.2 Class B: longitudinal seams, transverse joints and connections made airtight with sealant tape or combination thereof.
.3 Class C: transverse joints and connections made air tight with gaskets sealant tape or combination thereof. Longitudinal seams unsealed.
.4 Unsealed seams and joints.

2.2 SEALANT .1 Sealant: oil resistant, water borne, polymer type flame resistant duct sealant. Temperature range of minus 30°C to plus 93°C.

2.3 TAPE .1 Tape: polyvinyl treated, open weave fiberglass tape, 50 mm wide.

2.4 DUCT LEAKAGE .1 In accordance with SMACNA HVAC Air Duct Leakage Test Manual.

2.5 FITTINGS .1 Fabrication: to SMACNA.

.2 Radiused elbows.
.1 Rectangular: standard radius short radius with single thickness turning vanes Centreline radius: 1.5 times width of duct.
.2 Round: smooth radius five piece. Centreline radius: 1.5 times diameter.

.3 Mitred elbows, rectangular:
.1 To 400 mm: with single double thickness turning vanes.
.2 Over 400 mm: with double thickness turning vanes.

2.5 FITTINGS (Cont'd)

.4 Branches:
.1 Rectangular main and branch: with radius on branch 1.5 times width of duct 45 degrees entry on branch.
.2 Round main and branch: enter main duct at 45 degrees with conical connection.
.3 Provide volume control damper in branch duct near connection to main duct.
.4 Main duct branches: with splitter damper.

.5 Transitions:
.1 Diverging: 20 degrees maximum included angle.
.2 Converging: 30 degrees maximum included angle.

.6 Offsets:
.1 Full short radiused elbows as indicated.

.7 Obstruction deflectors: maintain full cross-sectional area.
.1 Maximum included angles: as for transitions.

2.6 FIRE STOPPING

.1 Retaining angles around duct, on both sides of fire separation.

.2 Fire stopping material and installation must not distort duct.

2.7 GALVANIZED STEEL

.1 Lock forming quality: to ASTM A653/A653M, Z90 zinc coating.

.2 Thickness, fabrication and reinforcement: to SMACNA.

.3 Joints: to SMACNA proprietary manufactured duct joint. Proprietary manufactured flanged duct joint to be considered to be a class A seal.

2.8 HANGERS AND SUPPORTS

.1 Hangers and Supports: in accordance with Section 23 05 29.
.1 Strap hangers: of same material as duct but next sheet metal thickness heavier than duct.
.1 Maximum size duct supported by strap hanger: 500.

2.8 HANGERS AND SUPPORTS (Cont'd)

.1 (Cont'd)

.2 Hanger configuration: to ASHRAE and SMACNA.

.3 Hangers: galvanized steel angle with galvanized steel rods to ASHRAE and SMACNA following table:

Duct Size (mm)	Angle Size (mm)	Rod Size (mm)
up to 750	25 x 25 x 3	6
751 to 1050	40 x 40 x 3	6
1051 to 1500	40 x 40 x 3	10
1501 to 2100	50 x 50 x 3	10
2101 to 2400	50 x 50 x 5	10
2401 and over	50 x 50 x 6	10

.4 Upper hanger attachments:

.1 For concrete: manufactured concrete inserts.

.2 For steel joist:manufactured joist clampsteel plate washer.

.3 For steel beams: manufactured beam clamps.

PART 3 - EXECUTION

3.1 GENERAL

.1 Do work in accordance with NFPA 90A, NFPA 90B ASHRAE, SMACNA as indicated.

.2 Do not break continuity of insulation vapour barrier with hangers or rods.

.1 Insulate strap hangers 100 mm beyond i.sulated duct Ensure diffuser is fully seated

.3 Support risers in accordance with ASHRAE SMACNA as indicated.

.4 Install breakaway joints in ductwork on sides of fire separation.

.5 Install proprietary manufactured flanged duct joints in accordance with manufacturer's instructions.

.6 Manufacture duct in lengths and diameter to accommodate installation of acoustic duct lining.

3.2 HANGERS

.1 Strap hangers: install in accordance with SMACNA.

.2 Angle hangers: complete with locking nuts and washers.

.3 Hanger spacing: in accordance with ASHRAE SMACNA as follows:

Duct Size (mm)	Spacing (mm)
to 1500	3000
1501 and over	2500

3.3 WATERTIGHT DUCT

.1 Provide watertight duct for:
.1 Fresh air intake.

.2 Form bottom of horizontal duct without longitudinal seams.
.1 Solder weld joints of bottom and side sheets.
.2 Seal other joints with duct sealer.

.3 Slope horizontal branch ductwork down towards fume hoods served.
.1 Slope header ducts down toward risers.

.4 Fit base of riser with 150 mm deep drain sump and 32 mm drain connected, with deep seal trap and valve trap primer and discharging to open funnel drain as indicated.

3.4 SEALING AND TAPING

.1 Apply sealant to outside of joint to manufacturer's recommendations.

.2 Bed tape in sealant and recoat with minimum of one coat of sealant to manufacturers recommendations.

END

PART 1 - GENERAL

1.1 REFERENCES

.1 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA)
.1 SMACNA - HVAC Duct Construction Standards - Metal and Flexible, 2005.

1.2 PRODUCT DATA

.1 Submit product data in accordance with Section 01 33 00.

.2 Indicate the following:
.1 Flexible connections.
.2 Duct access doors.
.3 Turning vanes.
.4 Instrument test ports.

1.3 CERTIFICATION OF RATINGS

.1 Catalogue or published ratings to be those obtained from tests carried out by manufacturer or independent testing agency signifying adherence to codes and standards.

1.4 WASTE MANAGEMENT AND DISPOSAL

.1 Refer to Section 01 74 20.

PART 2 - PRODUCTS

2.1 GENERAL

.1 Manufacture in accordance with SMACNA - HVAC Duct Construction Standards.

2.2 FLEXIBLE CONNECTIONS

.1 Frame: galvanized sheet metal frame 0.66 mm thick with fabric clenched by means of double locked seams.

.2 Material:
.1 Fire resistant, self extinguishing, neoprene coated glass fabric, temperature rated at minus 40°C to plus 90°C, density of 1.3 kg/m^2.

2.3 ACCESS DOORS IN DUCTS

.1 Non-insulated ducts: sandwich construction of same material as duct, one sheet metal thickness heavier, minimum 0.6 mm thick complete with sheet metal angle frame.

.2 Insulated ducts: sandwich construction of same material as duct, one sheet metal thickness heavier, minimum 0.6 mm thick complete with sheet metal angle frame and 25 mm thick rigid glass fibre insulation.

.3 Gaskets: neoprene foam rubber.

.4 Hardware:
.1 Up to 300 x 300 mm: two sash locks complete with safety chain.
.2 301 to 450 mm: four sash locks complete with safety chain.
.3 451 to 1000 mm: piano hinge and minimum two sash locks.
.4 Doors over 1000 mm: piano hinge and two handles operable from both sides.
.5 Hold open devices.
.6 300 x 300 mm glass viewing panels.

2.4 TURNING VANES

.1 Factory or shop fabricated single thickness double thickness with without trailing edge, to recommendations of SMACNA and as indicated.

2.5 INSTRUMENT TEST

.1 1.6 mm thick steel zinc plated after manufacture.

.2 Cam lock handles with neoprene expansion plug and handle chain.

.3 28 mm minimum inside diameter. Length to suit insulation thickness.

.4 Neoprene mounting gasket.

2.6 SPIN-IN COLLARS

.1 Conical galvanized sheet metal spin-in collars with lockable butterfly damper.

.2 Sheet metal thickness to co-responding round duct standards.

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Flexible connections:
- .1 Install in following locations:
  - .1 Inlets and outlets to supply air units and fans.
  - .2 Inlets and outlets of exhaust and return air fans.
  - .3 As indicated.
- .2 Length of connection: 100 mm.
- .3 Minimum distance between metal parts when system in operation: 75 mm.
- .4 Install in accordance with recommendations of SMACNA.
- .5 When fan is running:
  - .1 Ducting on sides of flexible connection to be in alignment.
  - .2 Ensure slack material in flexible connection.

.2 Access doors and viewing panels:
- .1 Size:
  - .1 x mm for person size entry.
  - .2 x mm for servicing entry.
  - .3 x mm for viewing.
  - .4 As indicated.
- .2 Locations:
  - .1 Fire dampers.
  - .2 Control dampers.
  - .3 Devices requiring maintenance.
  - .4 Required by code.
  - .5 Reheat coils.
  - .6 Elsewhere as indicated.

.3 Instrument test ports.
- .1 General:
  - .1 Install in accordance with recommendations of SMACNA and in accordance with manufacturer's instructions.
- .2 Locate to permit easy manipulation of instruments.
- .3 Install insulation port extensions as required.
- .4 Locations.
  - .1 For traverse readings:
    - .1 Inlets and outlets of other fan systems.
    - .2 Main and sub-main ducts.
    - .3 And as indicated.
  - .2 For temperature readings:
    - .1 At outside air intakes.

3.1 INSTALLATION (Cont'd)

.3 (Cont'd)

.4 (Cont'd)

.2 In mixed air applications in locations as approved by Departmental Representative Consultant.

.3 At inlet and outlet of coils.

.4 And as indicated.

.4 Turning vanes:

.1 Install in accordance with recommendations of SMACNA and as indicated.

END

PART 1 - GENERAL

1.1 REFERENCES

.1 Sheet Metal and Air Conditioning National Association (SMACNA)
.1 SMACNA HVAC Duct Construction Standards, Metal and Flexible-2005.

1.2 SUBMITTALS

.1 Shop Drawings and Product Data:
.1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 33 00. Include product characteristics, performance criteria, and limitations.

PART 2 - PRODUCTS

2.1 GENERAL

.1 Manufacture to SMACNA standards.

2.2 SPLITTER DAMPERS

.1 Of same material as duct but one sheet metal thickness heavier, with appropriate stiffening.

.2 Single Double thickness construction.

.3 Control rod with locking device and position indicator.

.4 Rod configuration to prevent end from entering duct.

.5 Pivot: piano hinge.

.6 Folded leading edge.

2.3 SINGLE BLADE DAMPERS

.1 Fabricate from same material as duct, but one sheet metal thickness heavier. V-groove stiffened.

.2 Size and configuration to recommendations of SMACNA, except maximum height 100 mm as indicated.

.3 Locking quadrant with shaft extension to accommodate insulation thickness.

2.3 SINGLE BLADE DAMPERS (Cont'd)

.4 Inside and outside nylon bronze end bearings.

.5 Channel frame of same material as adjacent duct, complete with angle stop.

2.4 MULTI-BLADED DAMPERS

.1 Factory manufactured of material compatible with duct.

.2 Opposed blade: configuration, metal thickness and construction to recommendations of SMACNA.

.3 Maximum blade height: 100 mm.

.4 Bearings: self-lubricating nylon.

.5 Linkage: shaft extension with locking quadrant.

.6 Channel frame of same material as adjacent duct, complete with angle stop.

.7 Maximum leakage: 0.07% at 750 Pa.

.8 Provide staff extension and standoff for insulated ducts.

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Install where indicated and required to balance system.

.2 Install in accordance with recommendations of SMACNA and in accordance with manufacturer's instructions.

.3 Install balancing dampers in each branch duct, for supply, return and exhaust systems.

.4 Runouts to registers and diffusers: install single blade damper located as close as possible to main ducts.

.5 All dampers to be vibration free.

.6 Ensure damper operators are observable and accessible.

END

PART 1 - GENERAL

1.1 REFERENCES

.1 ASTM International
.1 ASTM A653/A653M-11, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by Hot-Dip Process.

1.2 PRODUCT DATA

.1 Submit product data in accordance with Section 01 33 00.

.2 Indicate the following:
.1 Performance data.

1.3 CLOSEOUT SUBMITTALS

.1 Provide maintenance data for incorporation into manual specified in Section 01 78 00.

1.4 CERTIFICATION OF RATINGS

.1 Catalogue or published ratings shall be those obtained from tests carried out by manufacturer or those ordered by him from independent testing agency.

1.5 WASTE MANAGEMENT AND DISPOSAL

.1 Refer to Section 01 74 20.

PART 2 - PRODUCTS

2.1 MULTI-LEAF DAMPERS

.1 Opposed and or Parallel blade type as indicated.

.2 Structurally formed steel Extruded aluminum, interlocking blades, complete with extruded vinyl seals, spring stainless steel side seals, structurally formed and welded galvanized steel extruded aluminum frame.

.3 Pressure fit self-lubricated bronze bearings.

2.1 MULTI-LEAF DAMPERS (Cont'd)

.4 Linkage: plated steel tie rods, brass pivots and plated steel brackets, complete with plated steel control rod.

.5 Operator: To be supplied and installed by control sub-contractor.

.6 Performance:
.1 Leakage: in closed position in accordance with Class 1 leakage at 1kPa according to AMCA 511.
.2 Standard air leakage data to be certified under the AMCA certified ratings program.
.3 Pressure drop: at full open position to be less than 25 Pa differential across damper at 10 m/s.

.7 Insulated aluminum dampers:
.1 Frames: insulated with extruded polystyrene foam with R factor of 5.0.
.2 Blades: constructed from aluminum extrusions with internal hollows insulated with polyurethane or polystyrene foam, R factor of 5.0.
.3 Provide insulated damper for dampers exposed to outside air.

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Install where indicated.

.2 Install in accordance with recommendations of SMACNA and manufacturer's instructions.

.3 Seal multiple damper modules with silicon sealant.

.4 Ensure dampers are observable and accessible.

END

PART 1 - GENERAL

1.1 REFERENCES

.1 National Fire Protection Association (NFPA)
.1 NFPA 90A-2012, Installation of Air Conditioning and Ventilating Systems.

.2 Underwriters Laboratories of Canada (ULC)
.1 CAN/ULC-S112-10, Standard Method of Fire Test of Fire Damper Assemblies.
.2 CAN/ULC-S112.2-07, Standard Method of Fire Test of Ceiling Firestop Flap Assemblies.
.3 ULC-S505-1974, Fusible Links for Fire Protection Service.

1.2 PRODUCT DATA

.1 Submit product data in accordance with Section 01 33 00.

.2 Indicate the following:
.1 Fire dampers.
.2 Operators.
.3 Fusible links.
.4 Design details of break-away joints.

1.3 CLOSEOUT SUBMITTALS

.1 Provide maintenance data for incorporation into manual specified in Section 01 78 00.

1.4 CERTIFICATION OF RATINGS

.1 Catalogue or published ratings shall be those obtained from tests carried out by manufacturer or those ordered by him from independent testing agency signifying adherence to codes and standards.

PART 2 - PRODUCTS

2.1 FIRE DAMPERS

.1 Fire dampers: arrangement Type B, listed and bear label of ULC, meet requirements of provincial fire authority Fire Commissioner of Canada (FCC) CFFM and NFPA 90A and authorities having jurisdiction. Fire damper assemblies to be fire tested in accordance with CAN/ULC-S112.

.2 Mild steel, factory fabricated for fire rating requirement to maintain integrity of fire wall and/or fire separation. Minimum rating shall be 1-1/2 hr.

.3 Top hinged: single damper, round or square; multi-blade hinged or interlocking type; roll door type; guillotine type; sized to maintain full duct cross section as indicated.

.4 Fusible link actuated, weighted to close and lock in closed position when released or having negator-spring-closing operator for multi-leaf type or roll door type in horizontal position with vertical air flow.

.5 40 x 40 x 3 mm retaining angle iron frame, on full perimeter of fire damper, on both sides of fire separation being pierced.

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Install in accordance with NFPA 90A and in accordance with conditions of ULC listing.

.2 Maintain integrity of fire separation.

.3 After completion and prior to concealment obtain approvals of complete installation from authority having jurisdiction.

.4 Install access door adjacent to each damper. See Section 23 33 00.

.5 Coordinate with installer of firestopping.

.6 Ensure access doors/panels, fusible links, damper operators are easily observed and accessible.

3.1 INSTALLATION (Cont'd)

.7 Install break-away joints of approved design on each side of fire separation.

END

PART 1 - GENERAL

1.1 REFERENCES

.1 National Fire Protection Association (NFPA)
- .1 NFPA 90A-2012, Installation of Air Conditioning and Ventilating Systems.
- .2 NFPA 90B-2012, Installation of Warm Air Heating and Air Conditioning Systems.

.2 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA)
- .1 SMACNA HVAC Duct Construction Standards - Metal and Flexible, 2005.

.3 Underwriter's Laboratories of Canada (ULC)
- .1 CAN/ULC-S110-07, Fire Tests for Air Ducts.
- .2 UL 181-2005, Factory Made Air Ducts and Connectors.

1.2 PRODUCT DATA

.1 Submit product data in accordance with Section 01 33 00.

.2 Indicate the following:
- .1 Thermal properties.
- .2 Friction loss.
- .3 Acoustical loss.
- .4 Leakage.
- .5 Fire rating.

1.3 CERTIFICATION OF RATINGS

.1 Catalogue or published ratings to be those obtained from tests carried out by manufacturer or independent testing agency signifying adherence to codes and standards.

1.4 WASTE MANAGEMENT AND DISPOSAL

.1 Refer to Section 01 74 00.

PART 2 - PRODUCTS

2.1 GENERAL

.1 Factory fabricated to CAN/ULC-S110.

.2 Pressure drop coefficients listed below are based on relative sheet metal duct pressure drop coefficient of 1.00.

.3 Flame spread rating not to exceed 25. Smoke developed rating not to exceed 50.

2.2 METALLIC - UNINSULATED

.1 Type 1: spiral wound flexible aluminum stainless steel.

.2 Performance:
.1 Factory tested to 2.5 kPa without leakage.
.2 Maximum relative pressure drop coefficient: 3.

2.2 METALLIC ACOUSTIC INSULATED

.1 Type 5: Spiral wound, flexible perforated aluminum with factory applied 37 mm thick flexible glass fibre thermal insulation and sleeved by aluminum foil and Type M vapour barrier.

.2 Performance:
.1 Factory tested to 3 kPa without leakage.
.2 Maximum relative pressure drop coefficient: 3.
.3 Acoustical performance: Minimum attenuation (dB/m) to following table:

	Frequency (Hz)				
Duct Diam:	125	250	500	1000	2000
100	0.6	3	12	27	0
150	1.2	3	12	22	27
200	2.0	5	12	19	20
300	2.4	5	12	16	15

Frequency (Hz)

PART 3 - EXECUTION

3.1 DUCT INSTALLATION

.1 Install in accordance with: CAN/ULC S110, UL 181 NFPA 90A, NFPA 90B and SMACNA.

.2 Use type 5 throughout.

.3 Connections:
- .1 Duct Sizes 300 mm and Under:
  - .1 Provide a minimum of three (3) #8 sheet metal screws equally spaced to hold the flexible duct.
- .2 Duct sizes above 300 mm:
  - .1 Provide a minimum of five (5) #8 sheet metal screws equally spaced to hold the flexible duct.
- .3 Screws shall be located at least 12 mm from the end of the duct.
- .4 The collar to which the flexible duct is attached shall be a minimum 50 mm in length.
- .5 Cover entire joint with tape and seal as specified in 23 33 00 Air Duct Accessories.

.4 Supports:
- .1 Support shall be in accordance with SMACNA.
- .2 The maximum amount of sag for flexible duct shall not exceed 12 mm per foot. Provide additional supports as required.

.5 Length:
- .1 Maximum length of flexible duct: 3000 mm.
- .2 Minimum length of flexible duct connecting to ceiling diffusers shall be 1800 mm.

END

PART 1 - GENERAL

1.1 REFERENCES

.1 American Society for Testing and Materials (ASTM)
.1 ASTM C177-10, Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus.

.2 Canadian General Standards Board (CGSB)
.1 CGSB 51-GP-10M-76, Thermal Insulation, Mineral Fibre, Block or Board, for Ducting, Machinery and Boilers.
.2 CGSB 51-GP-11M-76, Thermal Insulation, Mineral Fibre, Blanket, for Piping, Ducting, Machinery and Boilers.

.3 National Fire Protection Association (NFPA)
.1 NFPA 90A-12, Standard for the Installation of Air Conditioning and Ventilating Systems.
.2 NFPA 90B-12, Standard for the Installation of Warm Air Heating and Air Conditioning Systems.

.4 Sheet Metal and Air Conditioning Contractor's National Association (SMACNA)
.1 SMACNA HVAC Duct Construction Standards, Metal and Flexible-95 (Addendum No.1, Nov. 97).

.5 Underwriter's Laboratories of Canada (ULC)
.1 CAN/ULC-S102-10, Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.

1.2 PRODUCT DATA

.1 Submit product data in accordance with Section 01 33 00.

1.3 WASTE MANAGEMENT AND DISPOSAL

.1 Refer to Section 01 74 20.

PART 2 - PRODUCTS

2.1 DUCT LINER

.1 General:
.1 Fibrous glass duct liner: air stream side faced with mat facing.
.2 Flame spread rating shall not exceed 25. Smoke development rating shall not exceed 50 when tested in accordance with CAN/ULC-S102.

.2 Rigid:
.1 Use on flat surfaces where indicated.
.2 25 mm thick, to CGSB 51-GP-10M, fibrous glass rigid board duct liner.
.3 Density: 36 kg/m^3 minimum.
.4 Thermal resistance to be minimum 0.76 m^2.°C/W for 25 mm thickness 1.15 m^2.°C/W for 38 mm thickness 1.51 m^2.°C/W for 50 mm thickness when tested in accordance with ASTM C177, at 24°C mean temperature.

2.2 ADHESIVE

.1 Meet requirements of NFPA 90A and NFPA 90B.

.2 Flame spread rating shall not exceed 25. Smoke development rating shall not exceed 50. Temperature range minus 29°C to plus 93°C.

2.3 FASTENERS

.1 Weld pins 2.0 mm diameter, length to suit thickness of insulation. Nylon Metal retaining clips, 32 mm square.

2.4 JOINT TAPE

.1 Poly-Vinyl treated open weave fiberglass membrane 50 mm wide.

2.5 SEALER

.1 Meet requirements of NFPA 90A and NFPA 90B.

.2 Flame spread rating shall not exceed 25. Smoke development rating shall not exceed 50. Temperature range minus 68°C to plus 93°C.

PART 3 - EXECUTION

3.1 GENERAL

.1 Do work in accordance with recommendations of SMACNA duct liner standards as indicated in SMACNA HVAC Duct Construction Standards, Metal and Flexible, except as specified otherwise.

.2 Line inside of ducts where indicated.

.3 Duct dimensions, as indicated, are clear inside duct lining.

3.2 DUCT LINER

.1 Install in accordance with manufacturer's recommendations, and as follows:
.1 Fasten to interior sheet metal surface with 100% coverage of adhesive.
.2 In addition to adhesive, install weld pins not less than 2 rows per surface and not more than 425 mm on centres.

3.3 JOINTS

.1 Seal butt joints, exposed edges, weld pin and clip penetrations and damaged areas of liner with joint tape and sealer. Install joint tape in accordance with manufacturer's written recommendations, and as follows:
.1 Bed tape in sealer.
.2 Apply two coats of sealer over tape.

.2 Replace damaged areas of liner at discretion of Departmental Representative.

.3 Protect leading and trailing edges of duct sections with sheet metal nosing having 15 mm overlap and fastened to duct.

END

PART 1 - GENERAL

1.1 RELATED SECTIONS

.1 Section 23 05 13 - Common Motor Requirements for HVAC Equipment.

.2 Section 23 05 48 - Vibrationfor HVAC Piping and Equipment.

.3 Section 23 33 00 - Air Duct Accessories.

1.2 REFERENCES

.1 Air Movement and Control Association (AMCA)
.1 AMCA 99-10, Standards Handbook.
.2 ANSI/AMCA 210-07/ANSI/ASHRAE 51-2007, Laboratory Methods of Testing Fans for Certified Aerodynamic Performance Rating.
.3 ANSI/AMCA 300-08, Reverberant Room Method for Sound Testing of Fans.
.4 ANSI/AMCA 301-06, Methods for Calculating Fan Sound Ratings from Laboratory Test Data.

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

1.3 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings and product data in accordance with Section 01 33 00.

.2 Provide :
.1 Fan performance curves showing point of operation, BHP kW and efficiency.
.2 Sound rating data at point of operation.

.3 Indicate: Motors, sheaves, bearings, shaft details
.1 Minimum performance achievable with variable speed controllers and variable inlet vanes as appropriate.

1.4 CLOSEOUT SUBMITTALS

.1 Provide operation and maintenance data for incorporation into manual specified in Section 01 78 00.

1.5 EXTRA MATERIALS

.1 Provide maintenance materials in accordance with Section 01 78 00.
.1 Spare parts to include:
.1 Matched sets of belts.

.2 Furnish list of individual manufacturer's recommended spare parts for equipment such as bearings and seals, and addresses of suppliers, together with list of specialized tools necessary for adjusting, repairing or replacing, for placement into operating manual.

1.6 MANUFACTURED ITEMS

.1 Catalogued or published ratings shall be those obtained from tests carried out by manufacturer or those ordered by him from independent testing agency signifying adherence to codes and standards in force.

PART 2 - PRODUCTS

2.1 FANS GENERAL

.1 Capacity: flow rate, total static pressure, bhp W, efficiency, revolutions per minute, power, model, size, sound power data and as indicated on schedule.

.2 Fans: statically and dynamically balanced, constructed in conformity with AMCA 99.

.3 Sound ratings: comply with ANSI/AMCA 301, tested to ANSI/AMCA 300. Unit shall bear AMCA certified sound rating seal.

.4 Performance ratings: based on tests performed in accordance with ANSI/AMCA 210/ANSI/ASHRAE 51. Unit shall bear AMCA certified rating seal, except for propeller fans smaller than 300 mm diameter.

.5 Motors:
.1 In accordance with Section 23 05 13 supplemented as specified herein.
.2 For use with variable speed controllers.
.3 Sizes as indicated specified.

.6 Accessories and hardware: matched sets of V-belt drives, adjustable slide rail motor bases, belt guards, coupling guards fan inlet and or outlet safety screens as indicated and as

2.1 FANS GENERAL (Cont'd)

.6 Accessories and hardware:(Cont'd) specified in Section 23 05 13. inlet outlet dampers and vanes and as indicated.

.7 Factory primed before assembly in colour standard to manufacturer.

.8 Scroll casing drains: as indicated.

.9 Finish on fume hood exhaust fans:.

.10 Bearing lubrication systems plus extension lubrication tubes where bearings are not easily accessible.

.11 Vibration isolation: to Section 23 05 48.

.12 Flexible connections: to Section 23 33 00.

2.2 CENTRIFUGAL FANS

.1 Fan wheels:
.1 Welded steel aluminumconstruction.
.2 Maximum operating speed of centrifugal fans not more than 40% of first critical speed.
.3 Air foil forward curved backward inclined blades, as indicated.

.2 Bearings: heavy duty split pillow-block flange mounted grease lubricated ball or roller self aligning type with oil retaining, dust excluding seals and a certified minimum rated life of 200,000 h.

.3 Shaft seals on laboratory fume hood and biological safety cabinet exhaust fans:
.1 Single disc multi-disc labyrinth water-cooled stuffing box carbon ring with nitrogen air purging seals.

.4 Housings:
.1 Volute with inlet cones: fabricated steel for wheels 300 mm or greater, cast iron, steel, aluminum, for smaller wheels, braced, and with welded supports.
.2 For horizontally and vertically split housings provide flanges on each section for bolting together, with gaskets of non-oxidizing non-flammable material.
.3 Provide bolted latched airtight access doors with handles.

2.2 CENTRIFUGAL FANS (Cont'd)

.5 Variable volume control devices:
.1 Mounted by fan manufacturer.
.2 Adjustable inlet vanes: operated from a centremechanism linked to each damper vane. Support each vane at ends in bronze bearings. On DWDI fans interconnect vanes to operate in unison. Provide locking devices for manual operation.
.3 Variable Speed Drives.

PART 3 - EXECUTION

3.1 FAN INSTALLATION

.1 Install fans as indicated, complete with resilient mountings specified in Section 23 05 48, flexible electrical leads and flexible connections in accordance with Section 23 33 00.

.2 Provide sheaves and belts required for final air balance.

.3 Bearings and extension tubes to be easily accessible.

.4 Access doors and access panels to be easily accessible.

.5 Clean and dynamically balance existing return fan. Motor for existing return fan to be replaced. Provide new VFD for existing return fan.

3.2 ANCHOR BOLTS AND TEMPLATES

.1 Size anchor bolts to withstand seismic acceleration and velocity forces as specified.

END

PART 1 - GENERAL

1.1 REFERENCES

.1 American National Standards Institute (ANSI)
.1 ANSI/ASHRAE 51-2007/AMCA 210-07, Laboratory Methods of Testing Fans for Rating.

.2 National Fire Protection Association (NFPA)
.1 NFPA 90A-12, Installation of Air Conditioning and Ventilating Systems.

.3 International Organization of Standardization (ISO)
.1 ISO 3741:2010, Acoustics-Determination of Sound Power Levels of Noise Sources Using Sound Pressure - Precision Methods for Reverberation Rooms.

.4 Underwriter's Laboratories (UL)

.5 UL 181-2008, Factory-Made Air Ducts and Air Connectors.

1.2 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings and product data in accordance with Section 01 33 00.

.2 Indicate the following:
.1 Capacity.
.2 Pressure drop.
.3 Noise rating.
.4 Leakage.

1.3 TEST REPORTS

.1 To ANSI/ASHRAE 51/AMCA 210. Submit published test data on DIN (Direct Internal Noise), in accordance with ISO 3741 made by independent testing agency for 0, 2.5 and 6 m/s branch velocity or inlet velocity. Sound power level with minimum inlet pressure of 0.5 kPa in accordance with ISO 3741 for 2nd through 7th octave band, also made by independent testing agency. Pressure loss through silencer shall not exceed 60% of inlet velocity pressure maximum.

1.4 CLOSEOUT SUBMITTALS

.1 Provide maintenance data for incorporation into manual specified in Section 01 11 00.

1.5 CERTIFICATION

.1 Catalogued or published ratings shall be those obtained from tests carried out by manufacturer or those ordered by him from certified ADC (Air Diffusion Council) testing agency signifying adherence to codes and standards.

1.6 WASTE MANAGEMENT AND DISPOSAL

.1 Refer to Section 01 74 00.

1.7 EXTRA MATERIALS

.1 Provide maintenance materials in accordance with Section 01 78 00.

PART 2 - PRODUCTS

2.1 MANUFACTURED UNITS

.1 Terminal units of the same type to be product of one manufacturer.

2.2 ELECTRONIC VARIABLE AIR VOLUME BOXES

.1 Terminal units of the same type to be product of one manufacturer

.2 Units: Pressure independent volume regulator type.

.3 Low pressure systems of single duct type with variable volume control and housed within sound attenuating box.

.4 Casing: 0.89 mm minimum thickness galvanized steel insulated with minimum of 25 mm thick thermal foil faced and acoustic insulation which complies with UL-181 and NFPA 90A. Any cut edges of fiberglass exposed to the airstream shall be covered with metal angles and end caps so there is no exposed fiberglass in the air stream

.5 The primary air valve damper shall be heavy gauge metal, with peripheral gasket, pivoted in self-lubricating bearings. In full closed position, air leakage past the closed damper

2.2 ELECTRONIC VARIABLE AIR VOLUME BOXES (Cont'd)

.5 (Cont'd)
shall not exceed 2% of the nominal catalog rating at 747 Pa inlet static pressure, as rated by ARI Standard 880. An opposed blade primary air damper and DDC motor operator shall vary primary air in response to a signal. Damper operation shall be demonstrated to be closed to minimum position before heating is activated. No overlap under any circumstances shall be allowed. Damper shall be located inside unit. Damper connection to operating shaft shall be a positive mechanical connection.

.6 The air flow sensor shall be of cross configuration located at the inlet of the assembly. The sensor shall have twelve total pressure sensing ports and a centre averaging chamber designed to accurately average the flow across the inlet of the assembly. Sensor shall provide accuracy within 5% with a 90 deg sheet metal elbow directly at the inlet of the assembly. The air flow sensor shall amplify the sensed air flow signal.

.7 Factory preset maximum and minimum air volume setting being field adjustable, and duct collars. Leakage through casing not to exceed 2% of design volume with 750 kPa upstream and 0 kPa downstream of regulator while maintaining flow regulation within 5% of setting as rated by ARI Standard 880.

.8 At an inlet velocity of 10.2 m/s pressure drop for cfm range of box shall not exceed 27 Pa.
.1 Radiated: 35 NC.
.2 Discharge: 36 NC. Based on room absorption of 10 db, and an inlet static pressure of 375 Pa.

.9 Provide minimum 915mm attenuator for discharge of every box. Attenuator shall have interior lining as previously specified, of 25 mm for its entire length.

.10 Provide terminal units with air volumes of 900 cfm or more with additional 600mm silencer section.

2.2 ELECTRONIC VARIABLE AIR VOLUME BOXES (Cont'd)

.11 In fully closed position, air leakage through damper shall not exceed 2% of catalogued rating at 750 Pa.

.12 Schedule: as indicated on the drawings.

.13 All digital controls including motor, transducer, controller, etc. to be supplied and installed by the BAS/ EMCS Control Contractor on site.

.14 Provide reheat coil sized in accordance with the schedule where indicated on the drawings.

.15 Provide an access door upstream of heating coil and dampers.

2.3 REHEAT COILS

.1 Plate fins shall be wavy with an offset fin design for maximum heat transfer performance, as well as maximum moisture collection capability to prevent blow off.

.2 Each coil shall be selected using a computer selection program approved by ARI Standard 410.

2.4 HEADER

.1 Headers and connection nozzles shall be either steel or non-ferrous material. Cast iron headers are not acceptable when supplied with female pipe threads. Female pipe thread connections are prone to breakage when piping connections are terminated.

.2 Header nozzles shall be either ASTM B88 copper or steel and shall be painted for rust protection. Headers shall be the same material type as nozzle.

.3 Connection nozzles (inlet and outlet) shall be on the same end of the coil.

.4 Male pipe thread connections shall be provided as standard. Grooved piping shall not be accepted.

2.5 TUBE SHEETS

.1 Coil shall provide a 12.7 mm mounting flange mechanically attached to the tube sheet, with 21.16 diameter mounting holes center to center for sturdy, accurate installation of the coil.

2.6 HAIRPIN AND COPPER TUBES

.1 Coil shall be manufactured using 180 degree continuous hairpin bends to reduce leak possibilities.

.2 Nipples shall be 15mm OD copper with 0.635mm all thickness and shall be machine brazed to the header.

.3 Coils shall be drainable with non-trapping circuits.

.4 The fin pack shall not exceed 14 fins per 25 mm.

.5 Fin shall be wavy using offset petal spacing collars with additional material downstream.

.6 Coil shall be tested to 2068 kPa and suitable for 1034 kPa working pressure.

2.7 CASING

.1 Side casings shall be 16 gauge ASTM B783 G60 galvanized steel riveted to the tube sheet. Approved option shall be 16 gauge 304L stainless steel casings. Coils shall have provision for bolting to adjacent ductwork and supporting structure.

.2 Heating coils shall have box flanges for strength and to facilitate stacking.

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Install in accordance with manufacturers recommendations.

.2 Support independently of ductwork.

.3 Install with at least 1000 mm of flexible inlet ducting and minimum of four duct diameters of straight inlet duct, same size as inlet.

.4 Locate so that controls, dampers and access panels are easily accessible.

END

PART 1 - GENERAL

1.1 PRODUCT DATA

.1 Submit product data in accordance with Section 01 33 00.

.2 Indicate the following:
- .1 Capacity.
- .2 Throw and terminal velocity.
- .3 Noise criteria.
- .4 Pressure drop.
- .5 Neck velocity.

1.2 SAMPLES

.1 Submit samples in accordance with Section 01 33 00.

1.3 CERTIFICATIONS

.1 Catalogued or published ratings shall be those obtained from tests carried out by manufacturer or those ordered by him from independent testing agency signifying adherence to codes and standards.

1.4 WASTE MANAGEMENT AND DISPOSAL

.1 Refer to Section 01 74 00.

PART 2 - PRODUCTS

2.1 GENERAL

.1 To meet capacity, pressure drop, terminal velocity, throw, noise level, neck velocity as indicated.

.2 Frames:
- .1 Full perimeter gaskets.
- .2 Plaster frames where set into plaster or gypsum board at all locations and as specified.
- .3 Concealed fasteners.

.3 Colour: standard as directed by Departmental Representative.

2.2 MANUFACTURED UNITS

.1 Grilles, registers and diffusers of same generic type to be product of one manufacturer.

2.3 RETURN AND EXHAUST GRILLES AND REGISTERS

.1 General: with opposed blade dampers.

.2 Type B: aluminum, 19 mm border, perforated type face bars. Finish: White.

2.4 DIFFUSERS

.1 Type A: aluminum, square type, plaque diffuser, lay-in and or surface mounted.
Finish: off-white.

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Install in accordance with manufacturers instructions.

END

PART 1 - GENERAL

1.1 REFERENCES

.1 National Fire Prevention Association (NFPA)

.1 NFPA 96-2011, Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations.

.2 American Society of Heating, Refrigeration and Air-Conditioning Engineers (ASHRAE)

.1 ASHRAE 52.2-2007, Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size. WITHDRAWN

.3 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-115.10-M90, Disposable Air Filters for the Removal of Particulate Matter from Ventilating Systems.

.2 CAN/CGSB-115.11-M85, Filters, Air, High Efficiency, Disposable, Bag Type (Reaffirmed April 1985).

.3 CAN/CGSB-115.12-M85, Filters, Air, Medium Efficiency, Disposable, Bag Type (Reaffirmed April 1985).

.4 CAN/CGSB-115.14-M91, High Efficiency Cartridge Type Supported Air Filters for the Removal of Particulate Matter from Ventilating Systems.

.5 CAN/CGSB-115.15-M91, High Efficiency Rigid Type Air Filters for Removal of Particulate Matter from Ventilating Systems.

.6 CAN/CGSB-115.18-M85, Filter, Air, Extended Area Panel Type, Medium Efficiency.

.4 Underwriters' Laboratories of Canada

.1 ULC-S111-07, Standard Method of Fire Tests for Air Filter Units.

.2 ULC-S649-06, Grease Filters for Commercial and Institutional Kitchen Exhaust Systems.

1.2 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawing and product data in accordance with Section 01 33 00.

1.3 CLOSEOUT SUBMITTALS

.1 Provide maintenance data for incorporation into manual specified in Section 01 78 00.

1.4 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Section 01 74 20, and with the Waste Reduction Workplan.

1.5 MAINTENANCE MATERIALS

.1 Provide maintenance materials in accordance with Section 01 78 00.

1.6 EXTRA MATERIALS

.1 Spare filters: in addition to filters to be installed immediately prior to acceptance by Departmental Representative, supply 1 complete set of filters for each filter unit or filter bank in accordance with Section 01 78 00.

PART 2 - PRODUCTS

2.1 GENERAL

.1 Media: suitable for air at 100% RH and air temperatures between minus 40 and 50°C.

.2 Number of units, size and thickness of panels, overall dimensions of filter bank, configuration and capacities: as indicated.

.3 Pressure drop when clean and dirty, sizes and thickness: as indicated on schedule.

2.2 ACCESSORIES

.1 Holding frames: permanent "T" section or channel section construction of galvanized steel or extruded aluminum same material as casing/hood, 1.6 mm thick, except where specified otherwise.

.2 Seals: to ensure leakproof operation.

.3 Blank-off plates: as required, to fit all openings and of same material as holding frames.

.4 Access and servicing: through doors/panels on each side or from upstream or downstream face of filter bank.

2.3 FILTER PERFORMANCE

.1 Pleated Panel Filters 500 ; MERV 8; UL 900 Class 2) (30 to 35% Dust Spot Efficiency)

.1 Each filter shall consist of an individual pleated media pack, enclosed in a clay coated board frame, with integral pleat stabilizers and support straps.

.2 The media shall be a blend of 100% virgin synthetic fibers. Media must also be self-supporting in pleated form, with no metal or plastic material laminated to the media to provide pleat support.

.3 The pleated media pack must be enclosed in a 1-piece, 28 pt. moisture resistant beverage carrier board frame. In addition to the perimeter frame, the filter must have three pleat stabilizers bonded to the media on the air leaving side and three support straps adhered to the air entering side of the filter. The pleat stabilizers must be made of moisture resistant beverage carrier board, and bonded to the media to maintain the proper pleat spacing throughout the life of the filter. The support straps are to be made from moisture resistant beverage carrier board and must be adhered along the tips of each pleat.

.4 Filters of the size and air flow capacity shall meet the following rated performance specifications based on the ASHRAE 52.2-1999 test method. Pertinent tolerances specified in Section 7.4 of the Air-Conditioning and Refrigeration Institute (ARI) Standard 850-93 shall apply to the performance ratings. All testing is to be conducted on filters with a nominal 600 x600 (24" x 24") face dimension.

Minimum Efficiency Reporting Value	8
Dust Holding Capacity (grams)	105
Nominal Size (Width x Height x Depth)	600 x 600 x 50 24 x 24 x 2
Rated Air Flow Capacity (cfm)	2000
Rated Air Flow Rate (feet per minute)	500
Final Resistance (inches w.g.)	1.0
Rated Initial Resistance (inches w.g.)	0.33

.5 The filters shall be approved and listed by Underwriters' Laboratories, Inc. as Class 2

2.3 FILTER PERFORMANCE (Cont'd)

.1 (Cont'd)

.5 (Cont'd)

when tested according to U. L. Standard 900 and CAN 4-5111.

.2 Extended Surface Cartridge Filters (300mm); MERV 13; UL 900 Class 1.

.1 Each filter shall consist of a pleated media pack contained in galvanized steel cell sides. The filters shall be capable of operating at temperatures up to 176 deg. The filters must fit without modification to the holding frames.

.2 The filter cell sides and single (peripheral) header shall be constructed of 30 gauge galvanized steel. The header and cell sides must be of unitized design, where the cell sides are interlocked with the header along the entire perimeter of the filter. This is to provide maximum sealing around the filter, eliminating the potential for air bypass. To further seal the contact between the header and cell sides, tape is applied at each corner of the filter to eliminate any bypass that may occur. The rear flanges of the cell sides should also be crimped to eliminate sharp edges and riveted to eliminate air bypass. One half inch wide bars of 20 gauge steel are riveted to the air leaving side of the filter to add supplemental support to the media pack.

.3 The media shall be made of micro glass fibers with a water repellent binder. The media shall be a dual density construction, with coarser fibers on the air entering side and finer fibers on the air leaving side.

.4 The media shall be pleated using corrugated aluminum separators. The edges of the separators shall be rolled over, to prevent any accidental abrasion or cutting of the media.

.5 During the pleating of the media, a small amount of adhesive is applied to each separator, which bonds the adjacent media to the separator. This provides a rigid media pack that minimizes any shifting or excessive movement of the pack which could damage the media. A layer of lofted, high efficiency media is applied between the media pack and the cell sides at the top and bottom of the filter. This provides a sealant for air bypass, as well as a cushion for the media pack during any shipping or handling. The media is glued along the sides of the filter to prevent air bypass.

.6 Filters of the size, air flow capacity and nominal efficiency (MERV) shall meet the following rated performance specifications based

2.3 FILTER PERFORMANCE (Cont'd)

.2 (Cont'd)

.6 (Cont'd)

on the ASHRAE 52.2-1999 test method. Where applicable, performance tolerance specified in Section 7.4 of the Air-Conditioning and Refrigeration Institute (ARI) Standard 850-93 shall apply to the performance ratings. All testing is to be conducted on filters with a nominal 600 x 600 mm (24"x24") header dimension.

Minimum Efficiency Reporting Value	13
Dust Spot Efficiency	80 to 90%
Dust Holding Capacity (grams)	130
Nominal Size (Width x Height x Depth)	24x24x12
Rated Air Flow Capacity (cfm)	2000
Rated Air Flow Rate (feet per minute)	500
Final Resistance (inches w.g.)	1.2
Rated Initial Resistance (inches w.g.)	0.56

.7 The filters shall be approved and listed by Underwriters' Laboratories, Inc. as Class 1 when tested according to U. L. Standard 900 and CAN 4 5111.

.3 Extended Surface V-Bank Cartridge Filters (300; MERV 13; UL 900 Class 2:

.1 Each filter shall consist of 8 pleated media packs assembled into 4 V banks within a totally plastic frame. The filters shall be capable of operating at temperatures up to 176 degrees Fahrenheit. The filters must either fit without modification or be adaptable to the existing holding frames. If adapters are required, they must be included in the total bid

2.3 FILTER PERFORMANCE (Cont'd)

.3 (Cont'd)

.1 (Cont'd)
price and notation of this requirement made on the bid form.

.2 The molded end panels are to be made of high impact polystyrene plastic. The center support members shall be made of ABS plastic. No metal components are to be used.

.3 The media shall be made of micro glass fibers with a water repellent binder. The media shall be a dual density construction, with coarser fibers on the air entering side and finer fibers on the air leaving side.

.4 The media shall be pleated using separators made of continuous beads of low profile thermoplastic material.

.5 The media packs shall be bonded to the structural support members at all points of contact, this improves the rigidity as well as eliminates potential air bypass in the filter.

.6 Filters of the size, air flow capacity and nominal efficiency (MERV) shall meet the following rated performance specifications based on the ASHRAE 52.2-1999 test method. Where applicable, performance tolerance specified in Section 7.4 of the Air-Conditioning and Refrigeration Institute (ARI) Standard 850-93 shall apply to the performance ratings. All testing is to be conducted on filters with a nominal 24"x24" header dimension.

Minimum Efficiency Reporting Value	13
Dust Spot Efficiency	80 to 90%
Dust Holding Capacity (grams)	430
Nominal Size (Width x Height x Depth	600x600x150
	24x24x6
Rated Air Flow Capacity (cfm)	2000
Rated Air Flow Rate (feet per minute)	500

Final Resistance (inches w.g.)	2.0
Rated Initial Resistance (inches w.g.)	0.34

.7 The filters shall be approved and listed by Underwriters' Laboratories, Inc. as Class 2 when tested according to U. L. Standard 900 and CAN 4 5111.4

2.4 FILTER GAUGES DIAL TYPE

.1 Diaphragm actuated, direct reading.

.2 Range: 0 to 2 times initial pressure 0 to 250 Pa.

PART 3 - EXECUTION

3.1 INSTALLATION GENERAL

.1 Install in accordance with manufacturer's recommendations and with adequate space for access, maintenance and replacement.

3.2 REPLACEMENT MEDIA

.1 Replace all media with new upon acceptance.

.2 Filter media to be new and clean, as indicated by pressure gauge, at time of acceptance.

3.3 FILTER GAUGES

.1 Install type across each filter bank (pre-filter and final filter) in approved and easy readable location.

.2 Mark each filter gauge with value of pressure drop for clean condition and manufacturer's recommended replacement (dirty) value.

END

PART 1 - GENERAL

1.1 REFERENCES

.1 American National Standards Institute/Air-Conditioning and Refrigeration Institute (ANSI/ARI)
.1 ANSI/ARI 430-2009, Central-Station Air-Handling Units.

.2 American Society of Heating, Refrigeration and Air Condition Engineers (ASHRAE)
.1 ANSI/ASHRAE 90.1-2010, (I-P) Energy Standard for Buildings Except Low-Rise Residential Buildings.
.2 ANSI/ASHRAE 52.2-2007, Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size.

.3 Canadian General Standards Board (CGSB)
.1 CAN/CGSB-1.181-99, Ready-Mixed Organic Zinc-Rich Coating.

.4 Master Painters Institute (MPI)
.1 MPI-INT 5.3-2007, Galvanized Metal.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00.

.2 Product Data:
.1 Provide manufacturer's printed product literature and datasheets for insulation, filters, adhesives, and paints, and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Shop Drawings:
.1 Indicate following: fan fan curves showing point of operation, motor drive, bearings, filters, mixing box, dampers, coil; include performance data, deep seal trap requirement.

.4 Sound power data for all fans and air handling units to be provided. Sound power data shall include sound power data for return fan inlet, suppy fan discharge and sound power levels radiated from the unit.

.5 Unit dimensions and weight.

1.2 ACTION AND INFORMATIONAL SUBMITTALS (Cont'd)

.6 Acoustical Performance

.1 Acoustical performance shall be established by AMCA standard 330, ASHRAE Standard 68 or ARI 260P procedures. Sound data shall be supplied that meets or exceeds requirements indicated on schedules.

1.3 CLOSEOUT SUBMITTALS

.1 Provide maintenance data for incorporation into manual specified in Section 01 78 00.

1.4 MAINTENANCE MATERIAL SUBMITTALS

.1 Provide maintenance materials in accordance with Section 01 78 00.

.2 Provide one spare sets of filters.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle in accordance with Section 01 61 00.

.2 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.

PART 2 - PRODUCTS

2.1 GENERAL

.1 Factory assembled components to form unit supplying air at designed conditions, as indicated.

.2 Access to mechanical room is limited to existing corridors and utility elevator. Maximum opening size for elevator is 1500 x x mm. Unit shall be transferred to the mechanical room in small sections and assembled on site. Assembly and internal wiring by Mechanical Contractor. Manufacturer's representative to supervise and inspect assembly of the unit.

.3 Certify ratings: to ANSI/ARI 430 with ARI seal.

.4 Horizontal Vertical type, as indicated, having air tight modular components, consisting of casing, fan section with motor and drive, filter section, dampers, heating coil, cooling coil, humidifier, mixing box, blender air mixing device, filter mixing box.

2.2 CASINGS

.1 Galvanized or Phosphate treated steel 1.65 mm thickness reinforced and braced for rigidity.
.1 Inspection doors: provide access for maintenance of internal parts.
.2 Paint steel parts, where not galvanized, with corrosion resistant paint to CAN/CGSB- 1.181.

.2 Line casing with solid steel liner. Thickness 0-111 mm.

2.3 ACOUSTIC LINER

.1 Ensure that expanded polystyrene and polyurethane insulation materials were not produced with ozone depleting substances.

.2 Insulate internal surface of panels with 50 mm neoprene coated rigid duct liner of 72 kg/m^3 density.

2.4 DRAIN PANS

.1 Construction: stainless steel. Rounded corners.

.2 Insulation: external foam type, minimum 13 mm thick.

.3 Drain connection: in bottom at low point.

.4 Installation: slope without sag minimum 1% to ensure no standing water at any time or at any point.

.5 Dimensions: minimum 75 mm from upstream face of coil to 150 mm beyond downstream face of coil or eliminator and to include return bends and headers.

2.5 FANS

.1 Fans shall be belt driven, double inlet, forward curved or backward airfoil as indicated in the specification or on the equipment schedules.

.2 All fans shall be tested in accordance with AMCA Standard 210-70 Test Code for Air Moving Devices. Fans to carry AMCA authorized seal.

.3 Fan housing shall be constructed of steel, continuously welded. All housings are equipped with spun intake cones designed for smooth air

2.5 FANS (Cont'd)

.3 (Cont'd)
flow. The housing shall be adequately braced with structural steel for rigidity.

.4 Fan shafts are to be solid, ground and polished, carbon steel, machined to close tolerances, keyed to the fan wheel and designed with its maximum operating speed not to exceed 75% of its first critical speed. Coat the shaft with rust inhibitor after machining. Hollow shafts will not be acceptable.

.5 Fan bearings shall be self aligning pillow block type with split tapered adapter locking sleeves, pre-lubricated with grease, heavy duty ball type, selected for an average life of 200,000 hours at design operating conditions. Bearings are to be mounted on the structural frame of the fan.

.6 Drive sheaves are to be machined cast iron minimim two groove. An adjustable motor sheave is provided on 7-1/2 HP and less. Sheave selection and belt lengths are to be in accordance with the drive manufacturer and shall be rated for a capacity greater than 125% (150%) of the motor HP. For motors greater than 7.5 HP provide one drive change for air balancing.

.7 Provide extended lubrication lines to permit lubrication for offside bearings from the access door side of the air handling unit.

.8 Maximum sound power levels, as indicated.

.9 Internally mounted motor and fan as indicated.

2.6 VIBRATION ISOLATION

.1 Flexible connections at inlet and outlet of fan section: to Section 23 33 00.

.2 Vibration isolators for supply and return fans: Type spring isolator, minimum deflection 50 mm in accordance with Section 23 05 48.

.3 Install unit on isolator neoprene pad, 6 mm thick in accordance with Section 23 05 48.

2.7 VARIABLE VOLUME DEVICES

.1 Refer to Section 23 05 14 - Variable Frequency Drives.

.2 Unit shall be provide with variable speed drive. A power connection point shall be provided for each variable speed drive for connection by Electrical Contractor. The wiring from the variable speed drive to the motor shall be factory wired by the unit manufacturer in accordance with Division 26 wiring methods.

2.8 FILTER BOX

.1 Material to match casing.
.1 Provide access to filter through hinged door with suitable hardware.

.2 Provide blank-off plates and gaskets to prevent air bypass.

.3 Filters: in accordance with Section 23 44 00.
.1 Minimum Efficiency Reporting Value (MERV) value 8 filtration media to ASHRAE 52.2, to be used on return air section of air handling unit.
.2 Immediately prior to occupancy, replace filtration media with new filtration media with Minimum Efficiency Reporting Value (MERV) of 13 in accordance with ASHRAE 52.2.

2.9 MIXING BOX

.1 Material to match casing and produce uniformly mixed air temperature within plus or minus 5 degrees C of design across face of outlet.

.2 Dampers:
.1 Dampers for mixing boxes: in accordance with Section 23 33 15.

2.10 STRATISFICATION ELIMINATORS

.1 General:
.1 Pre-engineered device with no moving parts, designed to thoroughly mix warm and cold air streams, to within 3 degrees C.

.2 Construction:
.1 2 mm thick aluminum or1.6 mm thick steel with corrosion resistant paint.

.3 Blender section:
.1 Blender in housing to match existing casing.

2.10 STRATISFICATION ELIMINATORS (Cont'd)

.4 Provide a minimum one diameter space downstream for adequate mixing of air stream.

2.11 COILS

.1 Capacity: as indicated.

.2 Ratings: ARI certified.

.3 Construction:
- .1 Casings: 1.5 mm thick galvanized sheet steel.
  - .1 Supports of galvanized steel channel or double angle frames.
  - .2 Blank-off plates. Insulated sandwich construction.
- .2 Hot and Chilled water coils: cleanable fins.
  - .1 Tubes: copper.
  - .2 Fins: aluminum.
  - .3 Headers: cast brass.
  - .4 Pressure tests: 1.7 MPa.

2.12 HUMIDIFIERS

.1 In accordance with Section 23 84 13 - Humidifiers.

.2 Air handling unit manufacturer shall mount steam grid provided by humidifier manufacturer. Balance of steam humidifier components shall be mounted in the field by the contractor. Provide minimum absorption distance downstream of humidifier as scheduled.

.3 Steam supply and drain connections shall be on the same side of the AHU with both pipe connections extended 150 mm beyond the casing exterior wall at the factory.

2.13 FILTER GAUGES

.1 Provide magnehelic gauges accurate to +/-2 percent of full range for each filter bank.

.2 Sensing probes and shut-off valves shall be provided for each gauge.

.3 One gauge shall be provided for each row of filters.

2.14 MARINE LIGHTS

.1 Provide marine lights with protective metal case and glass seals in each section. Provide wall beside the switch for the marine lights mounted adjacent to the supply fan access door.

.2 Provide one switch for all the Marine lights. Marine lights shall be provided for each section.

.3 Factory wire from the switch to the lights in rigid conduit with rain tight steel couplings and connectors. Electrical power shall be 120V/1/60.

2.15 ELECTRICAL REQUIREMENTS

.1 All unit power wiring shall enter unit cabinet at factory pre-drilled locations.

2.16 CONTROLS

.1 All controls shall be coordinated with the controls contractor. Refer to Section 25 of the specification for the sequence of operation.

.2 Damper actuators for all dampers being supplied and installed by Control Contractor.

.3 All sensors shall be supplied and installed in the field by the controls contractor with the exception of air flow measuring probe.

PART 3 - EXECUTION

3.1 APPLICATION

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

3.2 INSTALLATION

.1 Provide appropriate protection apparatus.

.2 Install units in accordance with manufacturer's instructions and as indicated.

.3 Ensure adequate clearance for servicing and maintenance.

3.2 INSTALLATION (Cont'd)

.4 Extend existing concrete pad to suit new unit. Modify concrete pad as required.

.5 Assemble unit on site. Test unit to confirm air leakage does not exceed specification.

.6 Manufacturer's representative shall be present during the test and shall certificate confirming installation and testing.

3.3 FANS

.1 Install fan sheaves required for final air balance.

.2 Install flexible connections at fan inlet and fan outlets.

.3 Install vibration isolators.

3.4 DRIP PANS

.1 Install deep seal P-traps on drip lines.
.1 Depth of water seal to be 1.5 times static pressure at this point.

3.5 CLEANING

.1 Clean in accordance with Section 01 74 11.

END

PART 1 - GENERAL

1.1 REFERENCES

.1 Canadian Standards Association (CSA)

.2 Underwriter's Laboratories of Canada (ULC).

1.2 SUBMITTALS

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

.2 Product Data:
.1 Submit manufacturer's printed product literature, specifications and datasheet for heating, ventilation and air conditioning distribution piping and ductwork.

.3 Shop Drawings:
.1 Submit shop drawings to indicate project layout, dimensions and extent of humidification system.
.1 Indicate following: dimensions and extend of humidification system.

.4 Test Reports: submit certified test reports from approved independent testing laboratories indicating compliance with specifications for specified performance characteristics and physical properties.

.5 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.6 Instructions: submit manufacturer's installation instructions.

.7 Manufacturer's field reports specified.

.8 Closeout submittals: submit maintenance and engineering data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

1.3 QUALITY ASSURANCE

.1 Health and Safety:
.1 Do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.

1.4 MAINTENANCE

.1 Extra Materials:
.1 Provide maintenance materials in accordance with Section 01 78 00 Closeout Submittals.
.2 Furnish list of individual manufacturer's recommended spare parts for equipment, addresses of suppliers, and list of specialized tools necessary for adjusting, repairing or replacing, for inclusion into operating manual.

PART 2 - PRODUCTS

2.1 ELECTRIC SELF-CONTAINED HUMIDIFIER

.1 The humidifier shall be ULC listed and CSA approved.

.2 Evaporating chamber, cover and fittings constructed from series 300 stainless steel with heliarc welded seams.

.3 Immersion heaters INCOLOY alloy-sheathed resistance type designed for no more than 0.12 watts per square mm.

.4 Immersion heater ends firmly attached to evaporating chamber.

.5 Single heating element shall be provided for each electrical phase.

.6 Humidifier to have the following heater protection features:
.1 Electronic sensing of low water.
.2 Over-temperature thermostat.
.3 Raised sacrifal heating element.

(Cont'd)

.7 Humidifier to contain the following operational and maintenance features:
.1 Water makeup valve control
.2 Auto/drain flush
.3 End-of-season drain
.4 Low water cutoff
.5 Surface skimmer
.6 Removable cover secured by threaded knobs
.7 Removable cleanout tray.

.8 Humidified capable of supporting tap and DI/RO water.

.9 Control cabinet ULC listed enclosure.

.10 Microprocessor-based control system to control automatic water refill, water surface skimming, low water cutoff, and periodic draining of evaporating chamber.

.11 Microprocessor-based control system capable of on/off, time-proportioning, or SCR modulating control of humidifier.

.12 Microprocessor to automatically rotate modulating duty between all heater groups to equalize operational time.

.13 Keypad provided to serve as human interface to controller. Keypad capable of monitoring and/or controlling the following parameters:
.1 Relative humidity (RH) SET-point and actual conditions in space (from humidistat or humidity transmitter).
.2 Relative humidity (RH) set-point and actual conditions in duct for variable air volume applications.
.3 Relative humidity (RH) high limit set-point and actual conditions.
.4 Heater group demand in % total humidifier capacity (or per humidifier in % when used with multiple-humidifier system).

.5 Total system demand in % of total humidifier capacity.
.6 Total system output in KG/HR.
.7 Auto drain/flush frequency interval and duration.
.8 End-of-season drain status.
.9 System fault indicator.

.13 (Cont'd)

(Cont'd)

.10 High limit and air flow proving circuit condition.

.11 Throttling range adjustment.

.12 Setting of cycle and delay time for time-proportioning modulation.

.13 "Time and service" message.

.14 Continuous readout of top line of display.

.14 Unit supplied with a stainless steel dispersion assembly complete with calibrated orifice tubelets. Provide assembly of connection between humidifier and dispersion tube assemble.

.15 Accessories

.1 A static-pressure-type or vane-type air flow proving switch.

.2 A 24-volt valve with end switch. Terminals provided in control cabinet for zone valve end switch connection.

.3 Factory mounted aquastat to sense and maintain the water temperature above freezing.

.4 Two-position high limit humidistat.

.5 VAV control package include two modulating electronic humidity transmitters transmitting to microprocessor.

.6 Cold weather offset sensor to transmit window glass temperature.

.7 Rigid fiberglass insulation covered with reinforced aluminum foil.

.8 NEMA 4 control cabinet.

.9 Air-cooled control cabinet.

.10 Water-level sight glass.

.11 Four support legs of length to provide 610 mm between underside of humidifier and floor.

.12 Wall brackets or floor mounted support to suit installation .

.13 The units shall have BACnet interface capability to building EMCS system.

.14 Drain cooler

.1 Provide drain cooler integral to the unit complete with all controls to limit drainage water not to exceed 60 deg C.

.2 Drain cooler to be connected to domestic cold water as indicated on the detail.

.16 Provide electric humidifiers complete with drain coolers and applicable steam injection per humidifier schedule.

2.2 DIRECT STEAM INJECTION TYPE

.1 System pressure:
   .1 Normal Operating: Atmospheric.
   .2 Suitable with electric humidifier.

.2 Stainless Steel Water/Steam Separator: Centrifugal type water/steam separator with an internal discharge tube which extends into the center of the separator for steam/condensation separation shall be provided. Separator shall be constructed of stainless steel with heli-arc welded seams.

.3 Condensate collection header.

.4 Close spaced steam Jacketed Dispersion Tube: Dispersion tube shall be constructed of stainless steel with heli-arc welded seams. Design of the dispersion tube shall provide steam jacketing for an internal tube which is fitted with two rows of high temperature tubelets.

.5 Each dispersion tube shall be fitted with two rows of high temperature tubelets inserted into the tube wall, centered on the diametric line, and spaced 40mm apart. These tubelets shall be made of thermal resin material designed for high temperature steam temperatures. The two rows of tubelets in each dispersion tube shall discharge steam in diametrically opposite directions.

.6 Each tubelet shall contain a steam orifice sized for its required steam capacity.

.7 Each humidifier panel assembly of tubes and headers shall be contained with a galvanized metal casing to allow convenient duct mounting, or to facilitate the stacking of and the end to end mounting of multiple humidifier panels in the air handling unit casing.

.8 All tubes and headers shall be 304 stainless steel and joints shall be Heli arc welded.

2.2 DIRECT STEAM INJECTION TYPE (Cont'd)

.9 Steam Valve: Valve shall be normally closed modulating type with modified linear flow characteristics and pneumatic actuator. Valve trim shall be stainless steel and valve maximum flow rate shall not exceed specified humidifier capacity by more than 20%.

.10 Steam Trap: Humidifier shall be provided with a float and thermostatic trap and a steam supply line strainer.

.11 High Limit Duct Humidistat: Compatible high limit duct humidistat shall be shipped loose for field installation. Humidistat shall sense humidity level with the duct and provide over-humidification protection.

.12 Air Flow Proving Switch: diaphragm operated, air flow proving switch shall be provided for field installation. Switch shall have an adjustable control point range of 12.4 Pa. to 3 kPa. and be rated for 1/4 H.P. at 125 VAC.

PART 3 - EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 INSTALLATION

.1 Install in accordance with manufacturer's instructions.

.2 Humidifiers to operate only when air flow is proven.

.3 Piping for humidification system shall be in accordance with Section 23 22 13 - Steam and Condensate Heating Piping.

3.2 INSTALLATION (Cont'd)

.4 Humidifier and evaporator media to be new and clean when project is accepted.

.5 Install humidistat as indicated in accessible location.

.6 Water service overflow drain: as indicated to manufacturers' recommendation.

.7 Install access doors or panels in adjacent ducting.

.8 All RO water piping, low pressure steam and condensate piping shall be stainless steel.

3.3 FIELD QUALITY CONTROL

.1 Manufacturer's Field Services:

.1 Have manufacturer of products, supplied under this Section, review Work involved in the handling, installation/application, and protection and cleaning, of its products and submit written reports, in acceptable format, to verify compliance of Work with Contract.

.2 Manufacturer's Field Services: provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.

.3 Schedule site visits, to review Work, at stages listed:

.1 After delivery and storage of products, and when preparatory Work, or other Work, on which the Work of this Section depends, is complete but before installation begins.

.2 Twice during progress of Work at 25% and 60% complete.

.3 Upon completion of the Work, after cleaning is carried out.

.4 Obtain reports, within 3 days of review, and submit, immediately, to Departmental Representative.

.2 Verification requirements in accordance with Section 01 47 17 - Sustainable Requirements: Contractor's Verification.

.3 Performance Verification (PV):

.1 General: in accordance with Section 01 91 13 General Commissioning (Cx)

3.3 FIELD QUALITY CONTROL (Cont'd)

.3 Performance Verification (PV):(Cont'd)

.1 General:(Cont'd)

Requirements: General Requirements, supplemented as specified.

.2 Application tolerances: 10%.

.3 Timing:

.1 After TAB of ducted air systems.

.2 At same time as PV of related air handling units.

.4 PV procedures:

.1 Direct Steam Injection Humidifiers.

.4 Start up:

.1 General: in accordance with Section 01 91 00 General Commissioning (Cx) Requirements: General Requirements, supplemented as specified.

.2 Verify:

.1 Steam lines are sloped to ensure steam condensate is drained away from the humidifier.

.2 Vapour lines and manifolds are sloped to ensure condensate is drained away from the duct system.

.3 Visually check distribution manifold to ensure:

.1 Even distribution of vapour.

.2 Freedom from water deposits.

.5 Commissioning Reports:

.1 General: in accordance with Section 01 91 00 General Commissioning (Cx) Requirements: reports, supplemented as specified. Include:

.1 PV results on approved PV Report Forms.

.2 Product Information Report Forms.

3.4 DEMONSTRATION

.1 Training: in accordance with Section 01 91 00 General Commissioning (Cx) Requirements.

3.5 CLEANING

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

.2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

3.5 CLEANING (Cont'd) .2 (Cont'd)

END

PART 1 - GENERAL

1.1 SUMMARY

.1 Section Includes.
.1 Methods and procedures for start-up, verification and commissioning, for building Energy Monitoring and Control System (EMCS) and includes:
.1 Start-up testing and verification of systems.
.2 Check out demonstration or proper operation of components.
.3 On-site operational tests.

.2 Related Sections.
.1 Section 01 91 00 - Commissioning.
.2 Section 01 79 00 - Demonstration and Training.
.3 Section 25 05 01 - EMCS: General Requirements.

1.2 DEFINITIONS

.1 For additional acronyms and definitions refer to Section 25 05 01.

.2 AEL: ratio between total test period less any system downtime accumulated within that period and test period.

.3 Downtime: results whenever EMCS is unable to fulfill required functions due to malfunction of equipment defined under responsibility of EMCS contractor. Downtime is measured by duration, in time, between time that Contractor is notified of failure and time system is restored to proper operating condition. Downtime not to include following:
.1 Outage of main power supply in excess of back-up power sources, provided that:
.1 Automatic initiation of back-up was accomplished.
.2 Automatic shut-down and re-start of components was as specified.
.2 Failure of communications link, provided that:
.1 Controller automatically and correctly operated in stand-alone mode.
.2 Failure was not due to failure of any specified EMCS equipment.

1.2 DEFINITIONS (Cont'd)

.3 Downtime:(Cont'd)

.3 Functional failure resulting from individual sensor inputs or output devices, provided that:

.1 System recorded said fault.

.2 Equipment defaulted to fail-safe mode.

.3 AEL of total of all input sensors and output devices is at least 99% during test period.

1.3 DESIGN REQUIREMENTS

.1 Confirm with Departmental Representative that Design Criteria and Design Intents are still applicable.

.2 Commissioning personnel to be fully aware of and qualified to interpret Design Criteria and Design Intents.

1.4 SUBMITTALS

.1 Submittals in accordance with Section 01 33 00.

.2 Final Report: submit report to Departmental Representative.

.1 Include measurements, final settings and certified test results.

.2 Bear signature of commissioning technician and supervisor

.3 Report format to be approved by Departmental Representative before commissioning is started.

.4 Revise "as-built" documentation, commissioning reports to reflect changes, adjustments and modifications to EMCS as set during commissioning and submit to Departmental Representative in accordance with Section 01 78 00.

.5 Recommend additional changes and/or modifications deemed advisable in order to improve performance, environmental conditions or energy consumption.

1.5 CLOSEOUT SUBMITTALS

.1 Provide documentation, O&M Manuals, and training of O&M personnel for review of Departmental Representative before interim acceptance in accordance with Section 01 78 00.

1.6 COMMISSIONING

.1 Do commissioning in accordance with Section 01 91 10.

.2 Carry out commissioning under direction of Departmental Representative and in presence of Departmental Representative and PWGSC Commissioning Manager.

.3 Inform, and obtain approval from, Departmental Representative in writing at least 14 days prior to commissioning or each test. Indicate:
.1 Location and part of system to be tested or commissioned.
.2 Testing/commissioning procedures, anticipated results.
.3 Names of testing/commissioning personnel.

.4 Correct deficiencies, re-test in presence of Departmental Representative until satisfactory performance is obtained.

.5 Acceptance of tests will not relieve Contractor from responsibility for ensuring that complete systems meet every requirement of Contract.

.6 Load system with project software.

.7 Perform tests as required.

1.7 COMPLETION OF COMMISSIONING

.1 Commissioning to be considered as satisfactorily completed when objectives of commissioning have been achieved and reviewed by Departmental Representative and PWGSC Commissioning Manager.

1.8 ISSUANCE OF FINAL CERTIFICATE OF COMPLETION

.1 Final Certificate of Completion will not be issued until receipt of written approval indicating successful completion of specified commissioning activities including receipt of commissioning documentation.

PART 2 - PRODUCTS

2.1 EQUIPMENT

.1 Provide sufficient instrumentation to verify and commission the installed system. Provide two-way radios.

.2 Instrumentation accuracy tolerances : higher order of magnitude than equipment or system being tested.

.3 Independent testing laboratory to certify test equipment as accurate to within approved tolerances no more than 2 months prior to tests.

.4 Locations to be approved, readily accessible and readable.

.5 Application: to conform to normal industry standards.

PART 3 - EXECUTION

3.1 PROCEDURES

.1 Test each system independently and then in unison with other related systems.

.2 Commission each system using procedures prescribed by the Commissioning Manager Departmental Representative.

.3 Commission integrated systems using procedures prescribed by Commissioning Manager Departmental Representative.

.4 Debug system software.

.5 Optimize operation and performance of systems by fine-tuning PID values and modifying CDLs as required.

.6 Test full scale emergency evacuation and life safety procedures including operation and integrity of smoke management systems under normal and emergency power conditions as applicable.

3.2 FIELD QUALITY CONTROL

.1 Pre-Installation Testing.

.1 General: consists of field tests of equipment just prior to installation.

.2 Testing may be on site or at Contractor's premises as approved by Departmental Representative.

.3 Configure major components to be tested in same architecture as designed system. Include BECC equipment and 2 sets of Building Controller's including MCU's, LCU's, and TCU's.

.4 Equip each Building Controller with sensor and controlled device of each type (AI, AO, DI, DO).

.5 Additional instruments to include:

.1 DP transmitters.

.2 VAV supply duct SP transmitters.

.3 DP switches used for dirty filter indication and fan status.

.6 In addition to test equipment, provide inclined manometer, digital micro-manometer, milli-amp meter, source of air pressure infinitely adjustable between 0 and 500 Pa, to hold steady at any setting and with direct output to milli-amp meter at source and to BECC.

.7 After setting, test zero and span in 10 % increments through entire range while both increasing and decreasing pressure.

.8 Departmental Representative to mark instruments tracking within 0.5% in both directions as "approved for installation".

.9 Transmitters above 0.5% error will be rejected.

.10 DP switches to open and close within 2% of setpoint.

.2 Completion Testing.

.1 General: test after installation of each part of system and after completion of mechanical and electrical hook-ups, to verify correct installation and functioning.

.2 Include following activities:

.1 Test and calibrate field hardware including stand-alone capability of each controller.

.2 Verify each A-to-D convertor.

.3 Test and calibrate each AI using calibrated digital instruments.

.4 Test each DI to ensure proper settings and switching contacts.

.5 Test each DO to ensure proper operation and lag time.

.6 Test each AO to ensure proper operation of controlled devices. Verify tight closure and signals.

3.2 FIELD QUALITY CONTROL (Cont'd)

.2 (Cont'd)

.2 Include following activities:(Cont'd)

.7 Test operating software.

.8 Test application software and provide samples of logs and commands.

.9 Verify each CDL including energy optimization programs.

.10 Debug software.

.11 Blow out flow measuring and static pressure stations with high pressure air at 700 kPa.

.12 Provide point verification list in table format including point identifier, point identifier expansion, point type and address, low and high limits and engineering units. Include space on commissioning technician and Departmental Representative. This document will be used in final startup testing.

.3 Final Startup Testing: Upon satisfactory completion of tests, perform point-by-point test of entire system under direction of Departmental Representative and PWGSC Commissioning Manager and provide:

.1 2 technical personnel capable of re-calibrating field hardware and modifying software.

.2 Detailed daily schedule showing items to be tested and personnel available.

.3 Departmental Representative's acceptance signature to be on executive and applications programs.

.4 Commissioning to commence during final startup testing.

.5 O&M personnel to assist in commissioning procedures as part of training.

.6 Commissioning to be supervised by qualified supervisory personnel and Departmental Representative.

.7 Commission systems considered as life safety systems before affected parts of the facility are occupied.

.8 Operate systems as long as necessary to commission entire project.

.9 Monitor progress and keep detailed records of activities and results.

.4 Final Operational Testing: to demonstrate that EMCS functions in accordance with contract requirements.

.1 Prior to beginning of 30 day test demonstrate that operating parameters (setpoints, alarm limits, operating control software, sequences of operation, trends,

3.2 FIELD QUALITY CONTROL (Cont'd)

.2 (Cont'd)

.4 Final Operational Testing:(Cont'd)

.1 (Cont'd)

graphics and CDL's) have been implemented to ensure proper operation and operator notification in event of off-normal operation.

.1 Repetitive alarm conditions to be resolved to minimize reporting of nuisance conditions.

.2 Test to last at least 30 consecutive 24 hour days.

.3 Tests to include:

.1 Demonstration of correct operation of monitored and controlled points.

.2 Operation and capabilities of sequences, reports, special control algorithms, diagnostics, software.

.4 System will be accepted when:

.1 EMCS equipment operates to meet overall performance requirements. Downtime as defined in this Section must not exceed allowable time calculated for this site.

.2 Requirements of Contract have been met.

.5 In event of failure to attain specified AEL during test period, extend test period on day-to-day basis until specified AEL is attained for test period.

.6 Correct defects when they occur and before resuming tests.

.5 Commissioning Manager Departmental Representative to verify reported results.

3.3 ADJUSTING

.1 Final adjusting: upon completion of commissioning as reviewed by Departmental Representative, set and lock devices in final position and permanently mark settings.

3.4 DEMONSTRATION

.1 Demonstrate to Departmental Representative operation of systems including sequence of operations in regular and emergency modes, under normal and emergency conditions, start-up, shut-down interlocks and lock-outs in accordance with Section 01 79 00.

END

PART 1 - GENERAL

1.1 SUMMARY

.1 Section Includes.
.1 Requirements and procedures for training program, instructors and training materials, for building Energy Monitoring and Control System (EMCS) Work.

.2 Related Sections.
.1 Section 25 05 01 - EMCS: General Requirements.

1.2 DEFINITIONS

.1 CDL - Control Description Logic.

.2 For additional acronyms and definitions refer to Section 25 05 01.

1.3 SUBMITTALS

.1 Submittals in accordance with Section 01 33 00, supplemented and modified by requirements of this Section.

.2 Submit reports within one week after completion of training program that training has been satisfactorily completed.

1.4 QUALITY ASSURANCE

.1 Provide bilingual, competent instructors thoroughly familiar with aspects of EMCS installed in facility.

.2 Depatmental Representative reserves right to approve instructors.

1.5 INSTRUCTIONS

.1 Provide instruction to designated personnel in adjustment, operation, maintenance and pertinent safety requirements of EMCS installed.

.2 Training to be project-specific.

1.6 TIME FOR INSTRUCTION

.1 Allow two, three hour sessions to cover the scope of the new work.

1.7 TRAINING MATERIALS

.1 Provide equipment, visual and audio aids, and materials for classroom training.

.2 Supply manual for each trainee, describing in detail data included in each training program.
.1 Review contents of manual in detail to explain aspects of operation and maintenance (O&M).

1.8 TRAINING PROGRAM

.1 Train O&M personnel in functional operations and procedures to be employed for system operations and associated changes being made.

1.9 MONITORING OF TRAINING

.1 Departmental Representative to monitor training program and may modify schedule and content.

PART 2 - PRODUCTS

2.1 NOT USED

.1 Not Used.

PART 3 - EXECUTION

3.1 NOT USED

.1 Not Used.

END

PART 1 - GENERAL

1.1 SUMMARY

.1 Related Sections:
.1 Section 25 05 02 - EMCS: Shop Drawings, Product Data and Review Process.
.2 Section 25 05 54 - EMCS: Identification.
.3 Section 25 90 01 - EMCS: Site Requirements Applications and Systems Sequences of Operation.

1.2 REFERENCES

.1 American National Standards Institute (ANSI)/The Instrumentation, Systems and Automation Society (ISA).
.1 ANSI/ISA 5.5-1985, Graphic Symbols for Process Displays.

.2 American National Standards Institute (ANSI)/ Institute of Electrical and Electronics Engineers (IEEE).
.1 ANSI/IEEE 260.1-1993, American National Standard Letter Symbols Units of Measurement (SI Units, Customary Inch-Pound Units, and Certain Other Units).

.3 American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. (ASHRAE).
.1 ASHRAE STD 135-R2001, BACNET - Data Communication Protocol for Building Automation and Control Network.

.4 Canadian Standards Association (CSA International).
.1 CAN/CSA-Z234.1-89(R1995), Canadian Metric Practice Guide.

.5 Consumer Electronics Association (CEA).
.1 CEA-709.1-B-2002, Control Network Protocol Specification.

.6 Department of Justice Canada (Jus).
.1 Canadian Environmental Assessment Act (CEAA), 1995, c. 37.
.2 Canadian Environmental Protection Act (CEPA), 1999, c. 33.

.7 Electrical and Electronic Manufacturers Association (EEMAC).
.1 EEMAC 2Y-1-1958, Light Gray Colour for Indoor Switch Gear.

1.2 REFERENCES (Cont'd)

.8 Health Canada/Workplace Hazardous Materials Information System (WHMIS).
.1 Material Safety Data Sheets (MSDS).

.9 Transport Canada (TC).
.1 Transportation of Dangerous Goods Act (TDGA), 1992, c. 34.

1.3 ACRONYMS AND ABBREVIATIONS

.1 Acronyms used in EMCS:
.1 AEL - Average Effectiveness Level.
.2 AI - Analog Input.
.3 AIT - Agreement on International Trade.
.4 AO - Analog Output.
.5 BACnet - Building Automation and Control Network.
.6 BC(s) - Building Controller(s).
.7 BECC - Building Environmental Control Center.
.8 CAD - Computer Aided Design.
.9 CDL - Control Description Logic.
.10 CDS - Control Design Schematic.
.11 COSV - Change of State or Value.
.12 CPU - Central Processing Unit.
.13 DI - Digital Input.
.14 DO - Digital Output.
.15 DP - Differential Pressure.
.16 ECU - Equipment Control Unit.
.17 EMCS - Energy Monitoring and Control System.
.18 HVAC - Heating, Ventilation, Air Conditioning.
.19 IDE - Interface Device Equipment.
.20 I/O - Input/Output.
.21 ISA - Industry Standard Architecture.
.22 LAN - Local Area Network.
.23 LCU - Local Control Unit.
.24 MCU - Master Control Unit.
.25 NAFTA - North American Free Trade Agreement.
.26 NC - Normally Closed.
.27 NO - Normally Open.
.28 OS - Operating System.
.29 O&M - Operation and Maintenance.
.30 OWS - Operator Work Station.
.31 PC - Personal Computer.
.32 PCI - Peripheral Control Interface.
.33 PCMCIA - Personal Computer Micro-Card Interface Adapter.
.34 PID - Proportional, Integral and Derivative.
.35 RAM - Random Access Memory.
.36 SP - Static Pressure.

1.3 ACRONYMS AND ABBREVIATIONS (Cont'd)

.1 (Cont'd)

.37 ROM - Read Only Memory.

.38 TCU - Terminal Control Unit.

.39 USB - Universal Serial Bus.

.40 UPS - Uninterruptible Power Supply.

.41 VAV - Variable Air Volume.

1.4 DEFINITIONS

.1 Point: may be logical or physical.

.1 Logical points: values calculated by system such as setpoints, totals, counts, derived corrections and may include, but not limited to result of and statements in CDL's.

.2 Physical points: inputs or outputs which have hardware wired to controllers which are measuring physical properties, or providing status conditions of contacts or relays which provide interaction with related equipment (stop, start) and valve or damper actuators.

.2 Point Name: composed of two parts, point identifier and point expansion.

.1 Point identifier: comprised of three descriptors, "area" descriptor, "system" descriptor and "point" descriptor, for which database to provide 25 character field for each point identifier. "System" is system that point is located on.

.1 Area descriptor: building or part of building where point is located.

.2 System descriptor: system that point is located on.

.3 Point descriptor: physical or logical point description. For point identifier "area", "system" and "point" will be shortforms or acronyms. Database must provide 25 character field for each point identifier.

.2 Point expansion : comprised of three fields, one for each descriptor. Expanded form of shortform or acronym used in "area", "system" and "point" descriptors is placed into appropriate point expansion field. Database must provide 32 character field for each point expansion.

.3 Bilingual systems to include additional point identifier expansion fields of equal capacity for each point name for second language.

.1 System to support use of numbers and readable characters including blanks, periods or underscores to enhance user readability for each of the above strings.

1.4 DEFINITIONS (Cont'd)

.3 Point Object Type: points fall into following object types:
.1 AI (analog input).
.2 AO (analog output).
.3 DI (digital input).
.4 DO (digital output).
.5 Pulse inputs.

.4 Symbols and engineering unit abbreviations utilized in displays: to ANSI/ISA S5.5.
.1 Printouts: to ANSI/IEEE 260.1.
.2 Refer also to Section 25 05 54.

1.5 SYSTEM DESCRIPTION

.1 Work covered by sections referred to above consists of fully operational EMCS, including, but not limited to, following:
.1 Building Controllers.
.2 Control devices as listed in I/O point summary tables.
.3 OWS(s).
.4 Data communications equipment necessary to effect EMCS data transmission system.
.5 Field control devices.
.6 Software/Hardware complete with full documentation.
.7 Complete operating and maintenance manuals.
.8 Training of personnel.
.9 Acceptance tests, technical support during commissioning, full documentation.
.10 Wiring interface co-ordination of equipment supplied by others.
.11 Miscellaneous work as specified in these sections and as indicated.

.2 Design Requirements:
.1 Design and provide conduit and wiring linking elements of system.
.2 Supply sufficient programmable controllers of types to meet project requirements. Quantity and points contents as reviewed by Departmental Representative prior to installation.
.3 Location of controllers as reviewed by Departmental Representative prior to installation.
.4 Provide utility power to EMCS and emergency power to EMCS as indicated.
.5 Metric references: in accordance with CAN/CSA Z234.1.

1.5 SYSTEM DESCRIPTION (Cont'd)

.3 Language Operating Requirements:
.1 To match existing.

1.6 SUBMITTALS

.1 Make submittals in accordance with Section 01 33 00.

.2 Co-ordinate submittal requirements and provide submittals required by Section 01 47 15.

.3 Submit for review:
.1 Equipment list and systems manufacturers at time of bid within 48 h within 10 days after award of contract.
.2 List existing field control devices to be re-used included in bid, along with unit price.

.4 Quality Control:
.1 Provide equipment and material from manufacturer's regular production, CSA certified, manufactured to standard quoted plus additional specified requirements.
.2 Where CSA certified equipment is not available submit such equipment to inspection authorities for special inspection and approval before delivery to site.
.3 Submit proof of compliance to specified standards with shop drawings and product data in accordance with Section 25 05 02. Label or listing of specified organization is acceptable evidence.
.4 In lieu of such evidence, submit certificate from testing organization, approved by Departmental Representative, certifying that item was tested in accordance with their test methods and that item conforms to their standard/code.
.5 For materials whose compliance with organizational standards/codes/specifications is not regulated by organization using its own listing or label as proof of compliance, furnish certificate stating that material complies with applicable referenced standard or specification.
.6 Permits and fees: in accordance with general conditions of contract.
.7 Submit certificate of acceptance from authority having jurisdiction to Departmental Representative.
.8 Existing devices intended for re-use: submit test report.

1.7 QUALITY ASSURANCE

.1 System being provided shall be compatible with existing system.

.2 Ensure qualified supervisory personnel continuously direct and monitor Work and attend site meetings.

.3 Health and Safety:
.1 Do construction occupational health and safety in accordance with Section 01 35 29.06.

1.8 DELIVERY, STORAGE AND HANDLING

.1 Material Delivery Schedule: provide Departmental Representative with schedule within 2 weeks after award of Contract.

1.9 EXISTING CONDITIONS - CONTROL COMPONENTS

.1 Utilize existing control wiring and piping where possible.

.2 Re-use field control devices that are usable in their original configuration provided that they conform to applicable codes, standards specifications.
.1 Do not modify original design of existing devices without written permission from Departmental Representative.
.2 Provide for new, properly designed device where re-usability of components is uncertain.

.3 Inspect and test existing devices intended for re-use within 30 days of award of contract, and prior to installation of new devices.
.1 Furnish test report within 40 days of award of contract listing each component to be re-used and indicating whether it is in good order or requires repair by Departmental Representative.
.2 Failure to produce test report will constitute acceptance of existing devices by contractor.

.4 Non-functioning items:
.1 Provide with report specification sheets or written functional requirements to support findings.
.2 Departmental Representative will repair or replace existing items judged defective yet deemed necessary for EMCS.

1.9 EXISTING CONDITIONS - CONTROL COMPONENTS (Cont'd)

.5 Submit written request for permission to disconnect controls and to obtain equipment downtime before proceeding with Work.

.6 Assume responsibility for controls to be incorporated into EMCS after written receipt of approval from Departmental Representative.
.1 Be responsible for items repaired or replaced by Departmental Representative.
.2 Be responsible for repair costs due to negligence or abuse of equipment.
.3 Responsibility for existing devices terminates upon final acceptance of EMCS applicable portions of EMCS as approved by Departmental Representative.

.7 Remove existing controls not re-used or not required. Place in approved storage for disposition as directed.

PART 2 - PRODUCTS

2.1 SCOPE OF WORK

.1 All new and replaced controls shall be DDC.

.2 Provide additional control module to accommodate the scope of work

.3 System being provided shall be compatible and similar with existing system. Existing system is Delta controls.

.4 Operator Working Station is not required. It is assumed existing OWS is being used since existing system is being utilized/

.5 Dismantle existing pneumatic controls tubing from exiting air handler, existing reheat and existing convectors. Ensure existing systems for the remainder of the building remains operational

.6 Provide new controls for the new air handler. This includes the following:
.1 Sensors and associated controls required to accommodate sequence of operation.
.2 Heating and cooling coil control valves for the air handler - Installation by mechanical contractor.

2.1 SCOPE OF WORK (Cont'd)

.6 (Cont'd)

.3 Flow station for supply and return. Installation by mechanical contractor.

.4 Controls for pumped coils - typical for two.

.5 Interlock air handler with fire alarm .

.7 Supply new control valves for new reheat coils and existing convectors. Installation by mechanical contractor. Interlock with new thermostats and terminal units.

.8 New thermostat as per drawings.

.9 Supply and install damper actuators for the air handlers. All dampers are being supplied by the unit manufacturer.

.10 Replace existing damper actuator for existing return fan.

.11 Supply and install terminal unit controllers. For quantity refer to the drawings.

.12 Return fan motor is being replaced and a variable frequency drive is being added. Control contactor to provide new wiring and additional sensors for the existing return fan.

.13 Provide controls for the humidifier control and humidification. Refer to section 23 84 11 for detail. Control contractor to provide sensors and wiring

.14 Electrical wiring associated with controls shall be carried out by control contractor.

2.2 EQUIPMENT

.1 Control Network Protocol and Data Communication Protocol: to CEA 709.1 ASHRAE STD 135.

.2 Complete list of equipment and materials to be used on project and forming part of bid documents by adding manufacturer's name, model number and details of materials, and submit for approval.

2.3 MATERIALS

.1 All products used in this project installation shall be new, currently under manufacture, and shall be applied in similar installations for a minimum of two years. This installation shall not be used as a test site for any new products unless explicitly approved by the Owner's Representative in writing. Spare parts shall be available for at least five years after completion of this contract.

2.4 DDC BAS CONTROLLERS

.1 Provide the necessary quantity of controllers compatible with existing systems as required to properly control the additional mechanical equipment specified under the scope of work.

2.5 ADVANCED APPLICATION CONTROLLERS

.1 The Advanced Application Controller shall have sufficient memory to support its operating system, database, and programming requirements.

.2 Advanced Application Controllers shall be fully peer to peer.

.3 The operating system of the Controller shall manage the input and output communication signals to allow distributed controllers to share real and virtual object information, and allow central monitoring and alarms.

.4 All equipment that requires scheduling shall be scheduled in that equipments controller.

.5 Both firmware and controller database shall be loadable over the network.

.6 Communication: Each Advanced Application Controller shall reside on a BACnet network using the MS/TP or Ethernet Data Link/ Physical layer protocol. The controller shall provide a service communication port using BACnet Data Link/ Physical layer protocol for connection to portable operator's workstation and allow access to the entire network.

2.5 ADVANCED APPLICATION CONTROLLERS (Cont'd)

.7 Environment: Controller hardware shall be suitable for the anticipated ambient conditions. Controllers used outdoors and/or in wet ambient conditions shall be mounted within waterproof enclosures, and shall be rated for operation at 0°C to 40°C [32°F to 100°F]. Controllers used in conditioned space shall be mounted in dust proof enclosures, and shall be rated for operation at 0°C to 50°C [32°F to 120°F].

.8 Serviceability: Provide diagnostic LEDs for power, communication, and processor. All wiring connections shall be made to field-removable, modular terminal strips - or to a termination card connected by a ribbon cable.

.9 Memory: The Advanced Application Controller shall be non-volatile FLASH memory. Immunity to power and noise. Controller shall be able to operate at 90% to 110% of nominal voltage rating and shall per form an orderly shut down below 80% nominal voltage. Operation shall be protected against electrical noise of 5 to 120 Hz and from keyed radios up to 5 W at 1 m [3 ft].

.10 Inputs: Controller input/output board shall support dry contact, 0-5 VDC and 0-10 VDC- voltage, 4-20 mA- current and thermistor-resistive signal types on an individual basis for connecting any status or sensing device. Analog resolution shall be 10-bit A to D.

.11 Outputs: Controller input/output board shall support built in HOA modules configured with manual-auto-off override switch, and input channel for feedback status. Output supported shall be 0-10 VDC. All HOA's shall be supervised.

.12 Diagnostics: Controller input/output board shall have red LEDs providing input status indication.

2.5 ADVANCED APPLICATION CONTROLLERS (Cont'd)

.12 Diagnostics:(Cont'd)

.13 External Power: Controller input/output board shall have one on-board 24 VDC terminal for directly connected active transducers.

2.6 APPLICATION SPECIFIC CONTROLLERS

.1 Application Specific Controllers (ASCs) are microprocessor-based DDC controllers which through hardware or firmware design are able to control a wide variety of equipment. They are fully user-programmable, and are not restricted to any one type of equipment.

.2 Each ASC shall be capable of standalone operation and shall continue to provide control functions without being connected to the network.

.3 Each ASC will contain sufficient I/O capacity to control the target system.

.4 Both firmware and controller database shall be loadable over the network.

.5 Application Specific Controllers shall be fully peer to peer.

.6 ASC's shall come with an integrated housing to allow for easy mounting and protection of the circuit board. Only wiring terminals shall be exposed.

.7 Communication: The controller shall reside on a BACnet network using the MS/TP Data Link/ Physical layer protocol. Each controller shall have a BACnet Data Link/ Physical layer compatible connection for a laptop computer or a

2.6 APPLICATION SPECIFIC CONTROLLERS (Cont'd)

.7 Communication:(Cont'd)
portable operator's tool. This connection shall be extended to a space temperature sensor port where shown and allow access to the entire network. Each controller shall have a secondary sub-network for communicating sensors or I/O expansion modules.

.8 Environment: The hardware shall be suitable for the anticipated ambient conditions. Controllers used outdoors and/or in wet ambient conditions shall be mounted within waterproof enclosures, and shall be rated for operation at -40°C to 65°C [40°F to 150°F] and/or suitably installed in a heated or fan cooled enclosure. Controllers used in conditioned space shall be mounted in dust proof enclosures, and shall be rated for operation at 0°C to 50°C [32°F to 120°F].

.9 Serviceability: Provide diagnostic LEDs for power, communication, and processor. All wiring connections shall be made to field-removable, modular terminal strips.

.10 Memory: The Application Specific Controller shall use non-volatile memory and maintain all BIOS and programming information in the event of a power loss.

.11 Immunity to power and noise: ASC shall be able to operate at 90% to 110% of nominal voltage rating and shall perform an orderly shutdown below 80%. Operation shall be protected against electrical noise of 5-120 Hz and from keyed radios up to 5 W at 1 m [3 ft].

.12 Transformer: Power supply for the ASC must be rated at minimum of 125% of ASC power consumption, and shall be fused or current limiting type.

.13 Input/Outputs: ASC shall support as a minimum, directly connected, a combination of analog

2.6 APPLICATION SPECIFIC CONTROLLERS (Cont'd)

.13 Input/Outputs:(Cont'd)
outputs and binary outputs and universal software selectable analog or digital inputs. ASC inputs shall support 0-5 VDC-voltage, 4-20mA-current, thermistor-resistance and dry contacts. ASC outputs shall support 0-10 VDC-voltage, digital triac rated at 0.5 amps at 24 VAC.

2.7 ADAPTORS

.1 Provide adaptors between metric and imperial components.

PART 3 - EXECUTION

3.1 MANUFACTURE'S RECOMMENDATIONS

.1 Installation: to manufacturer's recommendations.

3.2 PAINTING

.1 Painting: supplemented as follows:
.1 Clean and touch up marred or scratched surfaces of factory finished equipment to match original finish.
.2 Restore to new condition, finished surfaces too extensively damaged to be primed and touched up to make good.
.3 Clean and prime exposed hangers, racks, fastenings, and other support components.
.4 Paint unfinished equipment installed indoors to EEMAC 2Y-1.

END

PART 1 - GENERAL

1.1 SUMMARY

.1 Section Includes.
.1 Methods and procedures for shop drawings submittals, preliminary and detailed review process including review meetings, for building Energy Monitoring and Control System (EMCS).

1.2 DEFINITIONS

.1 Acronyms and definitions: refer to Section 25 05 01.

1.3 DESIGN REQUIREMENTS

.1 To match existing system.

1.4 SUBMITTALS

.1 Submittals in accordance with Section 01 33 00 and coordinate with requirements in this Section.

1.5 SHOP DRAWING REVIEW

.1 Submit shop drawings within 30 working days after award of contract and before start of installation and include following:
.1 Wiring diagrams.
.2 Piping diagrams and hook-ups.
.3 Interface wiring diagrams showing termination connections and signal levels for equipment to be supplied by others.
.4 Shop drawings for each input/output point, sensors, transmitters, showing information associated with each particular point including:
    .1 Sensing element type and location.
    .2 Transmitter type and range.
    .3 Associated field wiring schematics, schedules and terminations. .. Pneumatic schematics and schedules
    .4 Complete Point Name Lists.
    .5 Setpoints, curves or graphs and alarm limits (high and low, 3 types critical, cautionary and maintenance), signal range.
    .6 Software and programming details associated with each point.
    .7 Manufacturer's recommended installation instructions and procedures.

1.5 SHOP DRAWING REVIEW (Cont'd)

.1 (Cont'd)

.4 (Cont'd)

.8 Input and output signal levels or pressures where new system ties into existing control equipment.

.5 Control schematics, narrative description, CDL's fully showing and describing automatic and manual procedure required to achieve proper operation of project, including under complete failure of EMCS.

.6 Graphic system schematic displays of air and water systems with point identifiers and textual description of system, and typical floor plans as specified.

.7 Complete system CDL's including companion English language explanations on same sheet but with different font and italics. CDL's to contain specified energy optimization programs.

.8 Listing and example of specified reports.

.9 Listing of time of day schedules.

.10 Mark up to-scale construction drawing to detail control room showing location of equipment and operator work space.

.11 Type and size of memory with statement of spare memory capacity.

.12 Full description of software programs provided.

.13 Sample of "Operating Instructions Manual" to be used for training purposes.

.14 Outline of proposed start-up and verification procedures. Refer to Section 25 01 11.

1.6 QUALITY ASSURANCE

.1 Contractor's programmer to attend meeting.

.2 Departmental Representative retains right to revise sequence or subsequent CDL prior to software finalization without cost to Departmental Representative.

.3 Existing control system in the building is Delta.

PART 2 - PRODUCTS

2.1 NOT USED .1 Not Used.

PART 3 - EXECUTION

3.1 NOT USED .1 Not Used.

END

PART 1 - GENERAL

1.1 SUMMARY

.1 Section Includes.
.1 Requirements and procedures for final control diagrams and operation and maintenance (O&M) manual, for building Energy Monitoring and Control System (EMCS) Work.

.2 Related Sections.
.1 Section 01 78 00 - Closeout Submittals.
.2 Section 25 05 01 - EMCS: General Requirements.
.3 Section 25 05 02 - EMCS: Submittals and Review Process.
.4 Section 25 01 11 - EMCS: Start-up, Verification and Commissioning.

1.2 DEFINITIONS

.1 BECC - Building Environmental Control Centre.

.2 For additional acryonyms and definitions refer to Section 25 05 01.

1.3 SUBMITTALS

.1 Submittals in accordance with Section 01 78 00, supplemented and modified by requirements of this Section.

.2 Submit Record Documents As-built drawings Operation and Maintenance Manual to Departmental Representative Consultant in English and French.

.3 Provide soft copies and hard copies in hard-back, 50 mm 3 ring, D-ring binders.
.1 Binders to be 2/3 maximum full.
.2 Provide index to full volume in each binder.
.3 Identify contents of each manual on cover and spine.
.4 Provide Table of Contents in each manual.
.5 Assemble each manual to conform to Table of Contents with tab sheets placed before instructions covering subject.

1.4 AS-BUILTS

.1 Provide 1 copy of detailed shop drawings generated in Section 25 05 02 and include:
.1 Changes to contract documents as well as addenda and contract extras.

1.4 AS-BUILTS (Cont'd)

.1 (Cont'd)
.2 Changes to interface wiring.
.3 Routing of conduit, wiring and control air lines associated with EMCS installation.
.4 Locations of obscure devices to be indicated on drawings.
.5 Listing of alarm messages.
.6 Panel/circuit breaker number for sources of normal/emergency power.
.7 Names, addresses, telephone numbers of each sub-contractor having installed equipment, local representative for each item of equipment, each system.
.8 Test procedures and reports: provide records of start-up procedures, test procedures, checkout tests and final commissioning reports as specified in Section 25 01 11.
.9 Basic system design and full documentation on system configuration.

.2 Submit for final review by Departmental Representative Consultant.

.3 Provide before acceptance 4 Hard and 1 soft copy incorporating changes made during final review.

1.5 O&M MANUALS

.1 Custom design O&M Manuals (both hard and soft copy) to contain material pertinent to this project only, and to provide full and complete coverage of subjects referred to in this Section.

.2 Provide 2 complete sets of hard and soft copies prior to system or equipment tests

.3 Include complete coverage in concise language, readily understood by operating personnel using common terminology of functional and operational requirements of system. Do not presume knowledge of computers, electronics or in-depth control theory.

.4 Functional description to include:
.1 Functional description of theory of operation.
.2 Design philosophy.
.3 Specific functions of design philosophy and system.
.4 Full details of data communications, including data types and formats, data processing and disposition data link components,

1.5 O&M MANUALS (Cont'd)

.4 Functional description to include:(Cont'd)
.4 (Cont'd)
interfaces and operator tests or self-test of data link integrity.
.5 Explicit description of hardware and software functions, interfaces and requirements for components in functions and operating modes.
.6 Description of person-machine interactions required to supplement system description, known or established constraints on system operation, operating procedures currently implemented or planned for implementation in automatic mode.

.5 System operation to include:
.1 Complete step-by-step procedures for operation of system including required actions at each OWS.
.2 Operation of computer peripherals, input and output formats.
.3 Emergency, alarm and failure recovery.
.4 Step-by-step instructions for start-up, back-up equipment operation, execution of systems functions and operating modes, including key strokes for each command so that operator need only refer to these pages for keystroke entries required to call up display or to input command.

.6 Software to include:
.1 Documentation of theory, design, interface requirements, functions, including test and verification procedures.
.2 Detailed descriptions of program requirements and capabilities.
.3 Data necessary to permit modification, relocation, reprogramming and to permit new and existing software modules to respond to changing system functional requirements without disrupting normal operation.
.4 Software modules, fully annotated source code listings, error free object code files ready for loading via peripheral device
.5 Complete program cross reference plus linking requirements, data exchange requirements, necessary subroutine lists, data file requirements, other information necessary for proper loading, integration, interfacing, program execution.
.6 Software for each Controller and single section referencing Controller common parameters and functions.

.7 Maintenance: document maintenance procedures including inspection, periodic preventive

1.5 O&M MANUALS (Cont'd)

.7 Maintenance:(Cont'd)
maintenance, fault diagnosis, repair or replacement of defective components, including calibration, maintenance, repair of sensors, transmitters, transducers, controller and interface firmware's, plus diagnostics and repair/replacement of system hardware.

.8 System configuration document:
.1 Provisions and procedures for planning, implementing and recording hardware and software modifications required during operating lifetime of system.
.2 Information to ensure co-ordination of hardware and software changes, data link or message format/content changes, sensor or control changes in event that system modifications are required.

.9 Programmer control panel documentation: provide where panels are independently interfaced with BECC, including interfacing schematics, signal identification, timing diagrams, fully commented source listing of applicable driver/handler.

PART 2 - PRODUCTS

2.1 NOT USED

.1 Not Used.

PART 3 - EXECUTION

3.1 NOT USED

.1 Not Used.

END

PART 1 - GENERAL

1.1 SUMMARY

.1 Section Includes.
.1 Requirements and procedures for identification of devices, sensors, wiring tubing, conduit and equipment, for building Energy Monitoring and Control System (EMCS) Work and nameplates materials, colours and lettering sizes.

1.2 REFERENCES

.1 Canadian Standards Association (CSA International).
.1 CSA C22.1-09, The Canadian Electrical Code, Part I (21st Edition), Safety Standard for Electrical Installations.

1.3 DEFINITIONS

.1 For acronyms and definitions refer to Section 25 05 01.

1.4 SYSTEM DESCRIPTION

.1 Language Operating Requirements: provide identification for control items in English and French.

1.5 SUBMITTALS

.1 Submittals in accordance with Section 01 33 00 supplemented and modified by requirements of this Section.

PART 2 - PRODUCTS

2.1 NAMEPLATES FOR PANELS

.1 Identify by Plastic laminate, 3 mm thick Melamine, matt white finish, black core, square corners, lettering accurately aligned and engraved into core.

.2 Sizes: 25 x 67 mm minimum.

.3 Lettering: minimum 7 mm high, black.

.4 Inscriptions: machine engraved to identify function.

2.2 NAMEPLATES FOR FIELD DEVICES

.1 Identify by plastic encased cards attached by chain plastic tie.

.2 Sizes: 50 x 100 mm minimum.

.3 Lettering: minimum 5 mm high produced from laser printer in black.

.4 Data to include: point name and point address.

.5 Companion cabinet: identify interior components using plastic enclosed cards with point name and point address.

2.3 NAMEPLATES FOR ROOM SENSORS

.1 Identify by stick-on labels using point identifier.

.2 Location: as directed by Departmental Representative.

.3 Letter size: to suit, clearly legible.

2.4 WARNING SIGNS

.1 Equipment includingmotors, starters under remote automatic control: supply and install orange coloured signs warning of automatic starting under control of EMCS.

.2 Sign to read: "Caution: This equipment is under automatic remote control of EMCS" as reviewed by Departmental Representative.

2.5 WIRING

.1 Supply and install numbered tape markings on wiring at panels, junction boxes, splitters, cabinets and outlet boxes.

.2 Colour coding: to CSA C22.1. Use colour coded wiring in communications cables, matched throughout system.

.3 Power wiring: identify circuit breaker panel/circuit breaker number inside each EMCS panel.

2.6 PNEUMATIC TUBING

.1 Numbered tape markings on tubing to provide uninterrupted tracing capability.

.2 Identify where existing tubing is blanked-off.

2.7 CONDUIT

.1 Colour code EMCS conduit.

.2 Pre-paint box covers and conduit fittings.

.3 Coding: use fluorescent orange paint and confirm colour with Departmental Representative during "Preliminary Design Review".

PART 3 - EXECUTION

3.1 NAMEPLATES AND LABELS

.1 Ensure that manufacturer's nameplates, CSA labels and identification nameplates are visible and legible at all times.

3.2 EXISTING PANELS

.1 Correct existing nameplates and legends to reflect changes made during Work.

END

PART 1 - GENERAL

1.1 SUMMARY

.1 Section Includes.
.1 Requirements and procedures for warranty and activities during warranty period and service contracts, for building Energy Monitoring and Control System (EMCS).

1.2 DEFINITIONS

.1 BC(s) - Building Controller(s).

.2 For additional acronyms and definitions refer to Section 25 05 01.

1.3 SUBMITTALS

.1 Submittals in accordance with Section 01 33 00.

.2 Submit detailed preventative maintenance schedule for system components to Departmental Representative.

.3 Submit detailed inspection reports to Departmental Representative.

.4 Submit dated, maintenance task lists to Departmental Representative and include the following sensor and output point detail, as proof of system verification:
.1 Point name and location.
.2 Device type and range.
.3 Measured value.
.4 System displayed value.
.5 Calibration detail
.6 Indication if adjustment required,
.7 Other action taken or recommended.

.5 Submit network analysis report showing results with detailed recommendations to correct problems found.

.6 Records and logs: in accordance with Section 01 78 00.
.1 Maintain records and logs of each maintenance task on site.
.2 Organize cumulative records for each major component and for entire EMCS chronologically.
.3 Submit records to Departmental Representative, after inspection indicating that planned and systematic maintenance have been accomplished.

1.3 SUBMITTALS (Cont'd)

.7 Revise and submit to Departmental Representative in accordance with Section 01 78 00 "As-built drawings" documentation and commissioning reports to reflect changes, adjustments and modifications to EMCS made during warranty period.

1.4 MAINTENANCE SERVICE DURING WARRANTY PERIOD

.1 Provide services, materials, and equipment to maintain EMCS for specified warranty period. Provide detailed preventative maintenance schedule for system components as described in Submittal article.

.2 Emergency Service Calls:
.1 Initiate service calls when EMCS is not functioning correctly.
.2 Qualified control personnel to be available during warranty period to provide service to "CRITICAL" components whenever required at no extra cost.
.3 Furnish Departmental Representative with telephone number where service personnel may be reached at any time.
.4 Service personnel to be on site ready to service EMCS within 2 hours after receiving request for service.
.5 Perform Work continuously until EMCS restored to reliable operating condition.

.3 Operation: foregoing and other servicing to provide proper sequencing of equipment and satisfactory operation of EMCS based on original design conditions and as recommended by manufacturer.

.4 Work requests: record each service call request, when received separately on approved form and include:
.1 Serial number identifying component involved.
.2 Location, date and time call received.
.3 Nature of trouble.
.4 Names of personnel assigned.
.5 Instructions of work to be done.
.6 Amount and nature of materials used.
.7 Time and date work started.
.8 Time and date of completion.

.5 Provide system modifications in writing.
.1 No system modification, including operating parameters and control settings, to be

1.4 MAINTENANCE SERVICE DURING WARRANTY PERIOD (Cont'd)

.5 (Cont'd)
.1 (Cont'd)
made without prior written approval of Departmental Representative.

1.5 SERVICE CONTRACTS

.1 Provide in-depth technical expertise and assistance to Departmental Representative in preparation and implementation of service contracts and in-house preventive maintenance procedures.

.2 Service Contracts to include:
.1 Annual verification of field points for operation and calibration.
.2 visits per year.
.3 responses to emergency calls during day, per year.
.4 responses to emergency calls during silent hours per year.
.5 Silent hours defined as.
.6 Complete inventory of installed system.

PART 2 - PRODUCTS

2.1 NOT USED

.1 Not Used.

PART 3 - EXECUTION

3.1 FIELD QUALITY CONTROL

.1 Perform as minimum (1) one minor inspections and one major inspection (more often if required by manufacturer) per year. Provide detailed written report to Departmental Representative as described in Submittal article.

.2 Perform inspections during regular working hours, 0800 to 1630 h, Monday through Friday, excluding statutory holidays.

.3 Following inspections are minimum requirements and should not be interpreted to mean satisfactory performance:
.1 Perform calibrations using test equipment having traceable, certifiable accuracy at minimum 50% greater than accuracy of system displaying or logging value.

3.1 FIELD QUALITY CONTROL (Cont'd)

.3 (Cont'd)

.2 Check and Calibrate each field input/output device in accordance with Canada Labour Code - Part I and CSA Z204.

.3 Provide dated, maintenance task lists, as described in Submittal article, as proof of execution of complete system verification.

.4 Minor inspections to include, but not limited to:

.1 Perform visual, operational checks to BC's, peripheral equipment, interface equipment and other panels.

.2 Check equipment cooling fans as required.

.3 Visually check for mechanical faults, air leaks and proper pressure settings on pneumatic components.

.4 Review system performance with Operations Supervisor Departmental Representative to discuss suggested or required changes.

.5 Major inspections to include, but not limited to:

.1 Minor inspection.

.2 Clean OWS(s) peripheral equipment, BC(s), interface and other panels, micro-processor interior and exterior surfaces.

.3 Check signal, voltage and system isolation of BC(s), peripherals, interface and other panels.

.4 Verify calibration/accuracy of each input and output device and recalibrate or replace as required.

.5 Provide mechanical adjustments, and necessary maintenance on printers.

.6 Run system software diagnostics as required.

.7 Install software and firmware enhancements to ensure components are operating at most current revision for maximum capability and reliability.

.1 Perform network analysis and provide report as described in Submittal article.

.6 Rectify deficiencies revealed by maintenance inspections and environmental checks.

.7 Continue system debugging and optimization.

.8 Testing/verification of occupancy and seasonal-sensitive systems to take place during

3.1 FIELD QUALITY CONTROL (Cont'd)

.8 (Cont'd)
four (4) consecutive seasons, after facility has been accepted, taken over and fully occupied.

.1 Test weather-sensitive systems twice: first at near winter design conditions and secondly under near summer design conditions.

END

PART 1 - GENERAL

1.1 SUMMARY

.1 Related Sections:
.1 Section 23 33 15 - Dampers - Operating.
.2 Section 25 01 11 - EMCS: Start-Up, Verification and Commissioning.
.3 Section 25 05 01 - EMCS: General Requirements.
.4 Section 25 05 02 - EMCS: Shop Drawings, Product Data and Review Process.
.5 Section 25 05 54 - EMCS: Identification.
.6 Section 25 90 01 - EMCS: Site Requirements Applications and Systems Sequences of Operation.
.7 Section 26 05 01 - Common Work Results - Electrical.
.8 Section 26 27 10 - Modular Wiring System.
.9 Section 26 27 26 - Wiring Devices.

1.2 REFERENCES

.1 American National Standards Institute (ANSI).
.1 ANSI C12.7-1993(R1999), Requirements for Watthour Meter Sockets.
.2 ANSI/IEEE C57.13-08, Standard Requirements for Instrument Transformers.

.2 American Society for Testing and Materials International, (ASTM).
.1 ASTM B148-97(03), Standard Specification for Aluminum-Bronze Sand Castings.

.3 National Electrical Manufacturer's Association (NEMA).
.1 NEMA 250-03, Enclosures for Electrical Equipment (1000 Volts Maximum).

.4 Air Movement and Control Association, Inc. (AMCA).
.1 AMCA Standard 500-D-98, Laboratory Method of Testing Dampers For Rating.

.5 Canadian Standards Association (CSA International).
.1 CAN/CSA-C22.1-12, Canadian Electrical Code, Part 1 (22nd Edition), Safety Standard for Electrical Installations.

1.3 DEFINITIONS

.1 Acronyms and Definitions: refer to Section 25 05 01.

1.4 SUBMITTALS

.1 Submit shop drawings and manufacturer's installation instructions in accordance with Section 25 05 02.

.2 Manufacturer's Instructions:
.1 Submit manufacturer's installation instructions for specified equipment and devices.

1.5 EXISTING CONDITIONS

.1 Cutting and Patching: in accordance with Section 01 73 00 supplemented as specified herein.

.2 Repair surfaces damaged during execution of Work.

.3 Turn over to Departmental Representative existing materials removed from Work not identified for re-use.

PART 2 - PRODUCTS

2.1 GENERAL

.1 Control devices of each category to be of same type and manufacturer as existing systems.

.2 External trim materials to be corrosion resistant. Internal parts to be assembled in watertight, shockproof, vibration-proof, heat resistant, assembly.

.3 Operating conditions: 0 - 32°C with 10 - 90% RH (non-condensing) unless otherwise specified.

.4 Terminations: use standard conduit box with slot screwdriver compression connector block unless otherwise specified.

.5 Transmitters and sensors to be unaffected by external transmitters including walkie talkies.

.6 Account for hysteresis, relaxation time, maximum and minimum limits in applications of sensors and controls.

2.1 GENERAL (Cont'd)

.7 Outdoor installations: use weatherproof construction in NEMA 4 enclosures.

.8 Devices installed in user occupied space not exceed Noise Criteria (NC) of 35. Noise generated by any device must not be detectable above space ambient conditions.

.9 Range: including temperature, humidity, pressure, as indicated in I/O summary in Section 25 90 01.

2.2 TEMPERATURE SENSORS

.1 General: except for room sensors to be resistance or thermocouple type to following requirements:
.1 Thermocouples: limit to temperature range of 200 degrees C and over.
.2 RTD's: 100 or 1000 ohm at 0 degrees C (plus or minus 0.2 ohms) platinum element with strain minimizing construction, 3 integral anchored leadwires. Coefficient of resistivity: 0.00385 ohms/ohm °C.
.3 Sensing element: hermetically sealed.
.4 Stem and tip construction: copper or type 304 stainless steel.
.5 Time constant response: less than 3 seconds to temperature change of 10°C.
.6 Immersion wells: NPS 3/4, stainless steel spring loaded construction, with heat transfer compound compatible with sensor. Insertion length 100 150 mm as indicated.

.2 Room temperature sensors and display wall modules.
.1 Temperature sensing and display wall module.
.1 LCD display to show space temperature ed and temperature setpoint.
.2 Buttons for occupant selection of temperature setpoint and occupied/unoccupied mode.
.3 Jack connection for plugging in laptop personal computer contractor supplied zone terminal unit contractor supplied palm compatible handheld device for access to zone bus.
.4 Integral thermistor sensing element 10,000 ohm at 24 degrees.
.5 Accuracy 0.2°C over range of 0 to 70°C.
.6 Stability 0.02°C drift per year.

2.2 TEMPERATURE SENSORS (Cont'd)

.2 (Cont'd)
.1 (Cont'd)
.7 Separate mounting base for ease of installation.
.2 Room temperature sensors.
.1 Wall mounting, in slotted type covers having brushed aluminum brushed stainless steel finish, with guard as indicated.
.2 Element 10-50 mm long RTD with ceramic tube or equivalent protection or thermistor, 10,000 ohm, accuracy of plus or minus 0.2°C.

.3 Duct temperature sensors:
.1 Averaging duct type: incorporates numerous sensors inside assembly which are averaged to provide one reading. Minimum length 1500 mm. Bend probe at field installation time to 100 mm radius at point along probe without degradation of performance.

2.3 TEMPERATURE TRANSMITTERS

.1 Requirements:
.1 Input circuit: to accept 3-lead, 100 or 1000 ohm at 0 degrees C, platinum resistance detector type sensors.
.2 Power supply: 24 V DC into load of 575 ohms. Power supply effect less than 0.01°C per volt change.
.3 Output signal: 4 - 20 mA into 500 ohm maximum load.
.4 Input and output short circuit and open circuit protection.
.5 Output variation: less than 0.2% of full scale for supply voltage variation of plus or minus 10%.
.6 Combined non-linearity, repeatability, hysteresis effects: not to exceed plus or minus 0.5% of full scale output.
.7 Maximum current to 100 or 1000 ohm RTD sensor: not to exceed 25 mA.
.8 Integral zero and span adjustments.
.9 Temperature effects: not to exceed plus or minus 1.0% of full scale/ 50°C.
.10 Long term output drift: not to exceed 0.25% of full scale/ 6 months.
.11 Transmitter ranges: select narrowest range to suit application from following:
.1 Minus 50 degrees C to plus 50°C, plus or minus 0.5°C.
.2 0 to 100°C, plus or minus 0.5°C.
.3 0 to 50°C, plus or minus 0.25°C.
.4 0 to 25°C, plus or minus 0.1°C.

2.3 TEMPERATURE TRANSMITTERS (Cont'd)

.1 Requirements:(Cont'd)
.11 Transmitter ranges:(Cont'd)
.5 10 to 35°C, plus or minus 0.25 °C.

2.4 HUMIDITY SENSORS

.1 Room and Duct Requirements:
.1 Range: 20-80% RH minimum.
.2 Operating temperature range: 0 - 60 degrees C.
.3 Absolute accuracy:
.1 Duct sensors: plus or minus 3%.
.2 Room sensors: plus or minus 2%.
.4 Sheath: stainless steel with integral shroud for specified operation in air streams of up to 10 m/s.
.5 Maximum sensor non-linearity: plus or minus 2% RH with defined curves.
.6 Duct mounted sensors: locate so that sensing element is in air flow in duct.

.2 Outdoor Humidity Requirements:
.1 Range: 20-95% RH minimum.
.2 Operating temperature range: -40-75 °C.
.3 Absolute accuracy: plus or minus 2%.
.4 Temperature coefficient: plus or minus 0.03%RH/ degrees C over 0 to 50 degrees C.
.5 Must be unaffected by condensation or 100% saturation.
.6 No routine maintenance or calibration is required.

2.5 HUMIDITY TRANSMITTERS

.1 Requirements:
.1 Input signal: from RH sensor.
.2 Output signal: 4 - 20 mA onto 500 ohm maximum load.
.3 Input and output short circuit and open circuit protection.
.4 Output variations: not to exceed 0.2% of full scale output for supply voltage variations of plus or minus 10%.
.5 Output linearity error: plus or minus 1.0% maximum of full scale output.
.6 Integral zero and span adjustment.
.7 Temperature effect: plus or minus 1.0% full scale/ 6 months.
.8 Long term output drift: not to exceed 0.25% of full scale output/per year.

2.6 PRESSURE TRANSDUCERS

.1 Requirements:

.1 Combined sensor and transmitter measuring pressure.

.1 Internal materials: suitable for continuous contact with industrial standard instrument air, compressed air, water, steam, as applicable.

.2 Output signal: 4 - 20 mA into 500 ohm maximum load.

.3 Output variations: less than 0.2% full scale for supply voltage variations of plus or minus 10%.

.4 Combined non-linearity, repeatability, and hysteresis effects: not to exceed plus or minus 0.5% of full scale output over entire range.

.5 Temperature effects: not to exceed plus or minus 1.5% full scale/ 50°C.

.6 Over-pressure input protection to at least twice rated input pressure.

.7 Output short circuit and open circuit protection.

.8 Accuracy: plus or minus 1% of Full Scale.

2.7 DIFFERENTIAL PRESSURE TRANSMITTERS

.1 Requirements:

.1 Internal materials: suitable for continuous contact with industrial standard instrument air, compressed air, water, steam, as applicable.

.2 Output signal: 4 - 20 mA into 500 ohm maximum load.

.3 Output variations: less than 0.2% full scale for supply voltage variations of plus or minus 10%.

.4 Combined non-linearity, repeatability, and hysteresis effects: not to exceed plus or minus 0.5% of full scale output over entire range.

.5 Integral zero and span adjustment.

.6 Temperature effects: not to exceed plus or minus 1.5% full scale/50°C.

.7 Over-pressure input protection to at least twice rated input pressure.

.8 Output short circuit and open circuit protection.

.9 Unit to have 12.5 mm N.P.T. conduit connection. Enclosure to be integral part of unit.

2.8 STATIC PRESSURE SENSORS

.1 Requirements:

.1 Multipoint element with self-averaging manifold.

.1 Maximum pressure loss: 160 Pa at 10 m/s. (Air stream manifold).

.2 Accuracy: plus or minus 1% of actual duct static pressure.

2.9 STATIC PRESSURE TRANSMITTERS

.1 Requirements:

.1 Output signal: 4 - 20 mA linear into 500 ohm maximum load.

.2 Calibrated span: not to exceed 150% of duct static pressure at maximum flow.

.3 Accuracy: 0.4% of span.

.4 Repeatability: within 0.5% of output.

.5 Linearity: within 1.5% of span.

.6 Deadband or hysteresis: 0.1% of span.

.7 External exposed zero and span adjustment.

.8 Unit to have 12.5 mm N.P.T. conduit connection. Enclosure to be integral part of unit

2.10 VELOCITY PRESSURE SENSORS

.1 Requirements:

.1 Multipoint static and total pressure sensing element with self-averaging manifold with integral air equalizer and straightener section.

.2 Maximum pressure loss: 37 Pa at 1000 m/s.

.3 Accuracy: plus or minus 1% of actual duct velocity.

2.11 VELOCITY PRESSURE TRANSMITTERS

.1 Requirements:

.1 Output signal: 4 - 20 mA linear into 500 ohm maximum load.

.2 Calibrated span: not to exceed 125% of duct velocity pressure at maximum flow.

.3 Accuracy: 0.4% of span.

.4 Repeatability: within 0.1% of output.

.5 Linearity: within 0.5% of span.

.6 Deadband or hysteresis: 0.1% of span.

.7 External exposed zero and span adjustment.

.8 Unit to have 12.5 mm N.P.T. conduit connection. Enclosure to be integral part of unit.

2.12 TEMPERATURE SWITCHES

.1 Requirements:
.1 Operate automatically. Reset automatically, except as follows:
.1 Low temperature detection: manual reset.
.2 High temperature detection: manual reset.
.2 Adjustable setpoint and differential.
.3 Accuracy: plus or minus 1 degrees C.
.4 Snap action rating: 120V, 15 amps or 24V DC as required. Switch to be DPST for hardwire and EMCS connections.
.5 Type as follows:
.1 Room: for wall mounting on standard electrical box with without protective guard as indicated.
.2 Duct, general purpose: insertion length = 460 mm.
.3 Thermowell: stainless steel, with compression fitting for NPS 3/4 thermowell. Immersion length: 100 mm.
.4 Low temperature detection: continuous element with 6000 mm insertion length, duct mounting, to detect coldest temperature in any 30 mm length.

2.13 SOLID STATE RELAYS

.1 General:
.1 Relays to be socket or rail mounted.
.2 Relays to have LED Indicator.
.3 Input and output Barrier Strips to accept 14 to 28 AWG wire.
.4 Operating temperature range to be -20°C to 70°C.
.5 Relays to be CSA Certified.
.6 Input/output Isolation Voltage to be 4000 VAC at 25°C for 1 second maximum duration.
.7 Operational frequency range, 45 to 65 HZ.

.2 Input:
.1 Control voltage, 3 to 32 VDC.
.2 Drop out voltage, 1.2 VDC.
.3 Maximum input current to match AO (Analog Output) board.

.3 Output.
.1 AC or DC Output Model to suit application.

2.14 CURRENT TRANSDUCERS

.1 Requirements:

.2 Purpose: combined sensor/transducer, to measure line current and produce proportional signal in one of following ranges:
.1 4-20 mA DC.
.2 0-1 volt DC.
.3 0-10 volts DC.
.4 0-20 volts DC.

.3 Frequency insensitive from 10 - 80 hz.

.4 Accuracy to 0.5% full scale.

.5 Zero and span adjustments. Field adjustable range to suit motor applications.

.6 Adjustable mounting bracket to allow for secure/safe mounting inside MCC.

2.15 CURRENT SENSING RELAYS

.1 Requirements:
.1 Suitable to detect belt loss or motor failure.
.2 Trip point adjustment, output status LED.
.3 Split core for easy mounting.
.4 Induced sensor power.
.5 Relay contacts: capable of handling 0.5 amps at 30 VAC / DC. Output to be NO solid state.
.6 Suitable for single or 3 phase monitoring. For 3-Phase applications: provide for discrimination between phases.
.7 Adjustable latch level.

2.16 CONTROL DAMPERS

.1 Construction: blades, 152 mm wide, 1219 mm long, maximum. Modular maximum size, 1219 mm wide x 1219 mm high. Three or more sections to be operated by jack shafts.

2.17 ELECTRONIC CONTROL DAMPER ACTUATORS

.1 Requirements:
.1 Direct mount proportional type as indicated.
.2 Spring return for "fail-safe" in Normally Open or Normally Closed position as indicated.
.3 Operator: size to control dampers against maximum pressure and dynamic closing/opening pressure, whichever is greater.

2.17 ELECTRONIC CONTROL DAMPER ACTUATORS (Cont'd)

.1 Requirements:(Cont'd)
.4 Power requirements: 5 VA maximum at 24 V AC.
.5 Operating range: 0 - 10 V DC or 4 - 20 mA DC.
.6 For VAV box applications floating control type actuators may be used.
.7 Damper actuator to drive damper from full open to full closed in less than 120 seconds.

2.18 CONTROL VALVES

.1 Body: globe style, characterized ball.
.1 Flow characteristic linear, equal percentage, quick opening.
.2 Normally open for heating, Normally closed for cooling, as indicated.
.3 Two Three port, as indicated.
.4 Leakage rate ANSI class IV, 0.01% of full open valve capacity.
.5 Packing easily replaceable.
.6 Stem, stainless steel.
.7 Plug and seat, stainless steel, brass, bronze.
.8 Disc, replaceable, material to suit application.
.9 NPS 2 and under:
.1 Screwed National Pipe Thread (NPT) tapered female connections.
.2 Valves to ANSI Class 250, valves to bear ANSI mark.
.3 Rangeability 50:1 minimum.
.10 NPS 2½ and larger:
.1 Flanged connections.
.2 Valves to ANSI Class 150 as indicated, valves to bear ANSI mark.
.3 Rangeability 100:1 minimum.

.2 Butterfly Valves NPS 2 and larger:
.1 Body: for chilled water ANSI Class 150 cast iron lugged body and wafer body installed in locations as indicated. For heating water ANSI Class 150 carbon steel lugged body and wafer body.
.2 End connections to suit flanges that are ANSI Class 150.
.3 Extended stem neck to provide adequate clearance for flanges and insulation.
.4 Pressure limit: bubble tight sealing to 170 kilopascals.
.5 Disc/vane: 316 stainless steel, aluminum bronze to ASTM B 148.
.6 Seat: for service on chilled water PTFE (polytetrafluoroethylene) EPDM (ethylene

2.18 CONTROL VALVES (Cont'd)

.2 Butterfly Valves NPS 2 and larger:(Cont'd)

.6 Seat:(Cont'd)
propylene diene monomer). For service on heating water PTFE or RTFE (reinforced PTFE).

.7 Stem: 316 stainless steel.

.8 Flow factor (KV) as indicated on control valve schedule: CV in imperial units.

.9 Flow characteristic linear.

.10 Normally open for heating, Normally closed for cooling, as indicated.

.11 Valves are to be provided complete with mounting plate for installation of actuators.

2.19 ELECTRONIC / ELECTRIC VALVE ACTUATORS

.1 Requirements:

.1 Construction: steel, cast iron, aluminum.

.2 Control signal: 0-10V DC or 4-20 mA DC.

.3 Positioning time: to suit application. 90 sec maximum.

.4 Fail to normal position as indicated.

.5 Scale or dial indication of actual control valve position.

.6 Size actuator to meet requirements and performance of control valve specifications.

.7 For interior and perimeter terminal heating and cooling applications floating control actuators are acceptable.

.8 Minimum shut-off pressure: refer to control valve schedule.

2.20 PANELS

.1 Free-standing wall mounted enamelled steel cabinets with hinged and key-locked front door.

.2 Multiple panels as required indicated to handle requirements with additional space to accommodate 25% additional capacity as required by Departmental Representative without adding additional cabinets.

.3 Panels to be lockable with same key.

2.21 WIRING

.1 In accordance with Section 26 27 10 and 26 27 26.

.2 For wiring under 70 volts use FT6 rated wiring where wiring is not run in conduit. Other cases use FT4 wiring.

.3 Wiring must be continuous without joints.

2.21 WIRING (Cont'd)

.4 Sizes:
.1 Field wiring to digital device: #18AWG 20AWG stranded twisted pair.
.2 Analog input and output: shielded #18 minimum solid copper #20 minimum stranded twisted pair.

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Install equipment, components so that manufacturer's and CSA labels are visible and legible after commissioning is complete.

.2 Install field control devices in accordance with manufacturers recommended methods, procedures and instructions.

.3 Temperature transmitters, humidity transmitters, controllers, relays: install in NEMA I enclosure or as required for specific applications. Provide for electrolytic isolation in cases when dissimilar metals make contact.

.4 Support field-mounted panels, transmitters and sensors on pipe stands or channel brackets.

.5 Fire stopping: provide space for fire stopping. Maintain fire rating integrity.

.6 Electrical:
.1 Complete installation in accordance with Section 26 05 01.
.2 Trace existing control wiring installation and provide updated wiring schematics including additions, deletions to control circuits for review by Departmental Representative before beginning Work.
.3 Terminate wires with screw terminal type connectors suitable for wire size, and number of terminations.
.4 Install communication wiring in conduit.
.1 Provide complete conduit system to link Building Controllers, field panels and OWS(s).
.2 Conduit sizes to suit wiring requirements and to allow for future expansion capabilities specified for systems.
.3 Maximum conduit fill not to exceed 40%.

3.1 INSTALLATION (Cont'd)

.6 Electrical:(Cont'd)
.4 (Cont'd)
.4 Design drawings do not show conduit layout.
.5 Do not run exposed conduits in normally occupied spaces unless otherwise indicated or unless impossible to do otherwise. Departmental Representative to review before starting Work. Wiring in mechanical rooms, wiring in service rooms and exposed wiring must be in conduit.

.7 Pneumatic: provide Pneumatic tubing, valves and fittings for field control devices in accordance with Section 23 09 43.

.8 Mechanical: supply and install in accordance with Section 23 09 43.
.1 Pipe Taps.
.2 Wells and Control Valves.
.3 Air flow stations, dampers, and other devices.

.9 VAV Terminal Units: supply, install and adjust as required.
.1 Air probe, actuator and associated vav controls.
.2 Tubing from air probe to dp sensor as well as installation and adjustment of air flow sensors and actuators.
.3 Co-ordinate air flow adjustments with balancing trade.

3.2 TEMPERATURE AND HUMIDITY SENSORS

.1 Stabilize to ensure minimum field adjustments or calibrations.

.2 Readily accessible and adaptable to each type of application to allow for quick easy replacement and servicing without special tools or skills.

.3 Duct installations:
.1 Do not mount in dead air space.
.2 Locate within sensor vibration and velocity limits.
.3 Securely mount extended surface sensor used to sense average temperature.
.4 Thermally isolate elements from brackets and supports to respond to air temperature only.
.5 Support sensor element separately from coils, filter racks.

3.2 TEMPERATURE AND HUMIDITY SENSORS (Cont'd)

.4 Averaging duct type temperature sensors.
.1 Install averaging element horizontally across the ductwork starting 300 mm from top of ductwork. Each additional horizontal run to be no more than 300 mm from one above it. Continue until complete cross sectional area of ductwork is covered. Use multiple sensors where single sensor does not meet required coverage.
.2 Wire multiple sensors in series for low temperature protection applications.
.3 Wire multiple sensors separately for temperature measurement.
.4 Use software averaging algorithm to derive overall average for control purposes.

.5 Thermowells: install for piping installations.
.1 Locate well in elbow where pipe diameter is less than well insertion length.
.2 Thermowell to restrict flow by less than 30%.
.3 Use thermal conducting paste inside wells.

3.3 PANELS

.1 Arrange for conduit and tubing entry from top, bottom or either side.

.2 Wiring and tubing within panels: locate in trays or individually clipped to back of panel.

.3 Identify wiring and conduit clearly.

3.4 IDENTIFICATION

.1 Identify field devices in accordance with Section 25 05 54.

3.5 AIR FLOW MEASURING STATIONS

.1 Protect air flow measuring assembly until cleaning of ducts is completed.

3.6 TESTING AND COMMISSIONING

.1 Calibrate and test field devices for accuracy and performance in accordance with Section 25 01 11.

END

PART 1 - GENERAL

1.1 SUMMARY

.1 Section Includes:
.1 At minimum detailed narrative description of Sequence of Operation of each system including ramping periods and reset schedules.
.1 Control Description Logic (CDL) for each system.
.2 Input/Output Point Summary Tables for each system.
.3 System Diagrams consisting of the following; EMCS System architectural diagram, Control Design Schematic for each system (as viewed on OWS), System flow diagram for each system with electrical ladder diagram for MCC starter interface.

1.2 REFERENCES

.1 Public Works and Government Services Canada (PWGSC) / Real Property Branch / Architectural and Engineering Services.
.1 MD13800-September 2000, Energy Management and Control Systems (EMCS) Design Manual. English: ftp://ftp.pwgsc.gc.ca/rps/docentre/mechanical/me214-e.pdf

1.3 SEQUENCING

.1 Present sequencing of operations for systems, in accordance with MD13800 - Energy Management and Control Systems (EMCS) Design Manual.
.1.

1.4 AIR HANDLING UNIT AHU-24N

.1 General
.1 The unit serves the library and meeting rooms.
.2 The air handling unit consists of a supply fan and an existing remote return fan.
.3 The unit will operate as a variable volume unit.

.2 Safeties:
.1 All safeties listed in this section will override all operational control sequences unless explicitly stated not to.
.2 Where indicated a low limit thermostat located on the entering air side of the cooling coil is to be installed to protect the cooling

1.4 AIR HANDLING UNIT AHU-24N (Cont'd)

.2 Safeties:(Cont'd)

.2 (Cont'd)
coil against freezing. The low limit thermostat shall be hardwired to shut down the supply and exhaust/return fans upon detecting a temperature below 1.5°C on any 30 cm length of its sensing element. The low limit thermostat will signal the EMCS during a trip condition and, through a software program, will open the heating valve to 100% open. Once tripped, the limit must be reset manually. Protection shall work when the fan is in either hand or auto.

.3 The supply air temperature sensor will be used as a high limit device to protect the system from operating under very hot conditions. When the supply air temperature rises above 66.5°C the EMCS will shut down the unit through software. The limit must be manually reset at the EMCS through a reset parameter before the EMCS will restart the unit.

.4 The return air temperature sensor will be used as a high limit device to protect the system from operating under very hot conditions. When the return air temperature rises above 66.5°C the EMCS will shut down the unit through software. The limit must be manually reset at the EMCS through a reset parameter before the EMCS will restart the unit.

.5 The EMCS will not enable humidification, dampers or cooling until supply fan status is received

.6 Low Limit Thermostat : Hard Wired to Variable Frequency Drives by Controls Contractor - Action: Fans off

.7 Fire Alarm: Hard wired to Variable Frequency Drives by Electrical Contractor - Action: Fans off.

.8 High Supply Air Temperature: Software Shutdown - Action: Fans off.

.9 High Return Air Temperature : Software Shutdown - Action: Fans off.

.3 Dampers

Damper	**Type**	**Operation**
Outside Air	Opposed Blade	Spring return to closed position
Exhaust Air	Opposed Blade	Spring return to closed position

1.4 AIR HANDLING UNIT AHU-24N (Cont'd)

.3 (Cont'd)

Damper	Type*	Operation*
Return Air	Opposed Blade	Spring return to open position

.4 Initial Temperature and Humidity Setpoints:
.1 Heating: 22 C 30% RH
.2 Cooling: 24 C 55% RH (Design condition, Unit does not have a dehumidification sequence.)

.5 System Start-Up
.1 System start-up shall be by the Operator at the Operator workstation or by time of day scheduling. The schedule for the unit shall be established prior to system start up.

.6 System Shut-Down
.1 System shut-down shall be by the Operator or time of day schedule.

.7 Equipment Start-Up
.1 If any of the variable frequency drives are in their Local control position, indicate this on the system graphic.
.2 If any of the shut down alarms are still active, the EMCS shall not be allowed to start up the equipment.
.3 On system start up command start the return fan at minimum speed. Confirm that the fan is running at the variable frequency drive. If the fan is not running within 30 seconds commence an auto shutdown and alarm at the EMCS.
.4 Once the return fan is running, send a start up command to the supply fan at minimum speed. Confirm that the fan is running at the variable frequency drive. If the fan is not running within 30 seconds commence auto shutdown and alarm at the EMCS.
.5 Wait for the supply fan and return fan to both be running at minimum speed. Once they are at minimum speed enable the temperature and humidity controls.
.6 Turn all PID loops to Auto. The last available loop output shall be utilized as the starting point.
.7 Enable the air flow stations.

1.4 AIR HANDLING UNIT AHU-24N (Cont'd)

.7 (Cont'd)

.8 Ramp up the speed of the variable frequency drive to bring the supply air static pressure to setpoint. Monitor the supply air volume at the flow station. The return fan shall track the supply fan utilizing the return air flow station.

.9 If the air flows are not within 10% of setpoint within 5 minutes alarm at the EMCS.

.10 The status of the return fan and supply fan shall be graphically displayed at the EMCS.

.11 Once the supply fan and return fan are running enable the temperature and humidity controls.

.12 Enable pressure and air flow alarms.

.13 Establish a minimum outside air flow rate

.14 20 minutes after the air handling unit is running enable the space temperature setpoint and space humidity setpoint alarms.

.15 Show the unit as running on the graphic display, once all of the above are operating.

.8 Equipment Shut-Down

.1 Equipment shut down shall be by the operator at the Operator Workstation or time of day scheduling

.2 Save all temperature valve loop outputs.

.3 Place all loops in manual.

.4 Close the cooling valve.

.5 Turn heating pump coil on and modulate the three way control valve to maintain 18 deg C in the mixed air plenum when outdoor air temperatures are below 2C.

.6 Shut down the return fan.

.7 Shut-down the supply fan.

.8 Close the exhaust air damper and the outside air damper and open the mixed air damper.

.9 Show the unit as off on the graphic display.

.9 Alarm Shut-Down

.1 Show the unit as Alarm Shut Down on the graphic display.

.10 Alarms

1.4 AIR HANDLING UNIT AHU-24N (Cont'd)

.10 (Cont'd)

.1 Legend

.1 AS - Alarm Shut-down

.2 M - Maintenance

.3 T - Trouble

.4 C - Critical Alarm

Alarm	Condition	Type	Action
Fire Alarm		C	AS
Low Limit Thermostat		C	AS
High Supply Air Temperature 66.5 C	Above 66.5C	C	AS
High Exhaust Air Temperature 66.5C	Above 66.5C	C	AS
Return Fan VFD Failure		C	AS
Supply Fan VFD Failure		C	AS
High Supply Air Static	Above 375Pa WC	C	AS
Failure of Three Exhaust Fans		C	AS
Low Limit Supply Air Temperature	Less than 7.2C	C	AS
Supply Air Static	Greater than 250 Pa & Less than 375 Pa WC	T	
Room Humidity Alarms		T	
Filter Pressure Drop Above Setpoint	Merv 8 250Pa	M	
	Merv 13: 250	M	
VFD in Off Position at Drive		M	

.11 Occupied Mode

.1 In the occupied mode the minimum setting for the outside air damper shall be set to

1.4 AIR HANDLING UNIT AHU-24N (Cont'd)

.11 (Cont'd)

.1 (Cont'd)
maintain a minimum outside air flow rate as per schedule

.12 Unoccupied Mode

.1 In the unoccupied mode the unit shall be off and shall be off and the space temperature shall be reset to 18.3 C. The perimeter radiation control valves shall be utilized to maintain the space at this temperature. If any of the space temperature sensors indicates a temperature below 15.6 °C the unit shall be restarted in full recirculation mode and shall raise the space temperature to setpoint.

.2 Once the space reaches setpoint the unit shall shut off. If the space temperature sensor/sensors indicate a temperature above 26.7 °C (the unit shall be restarted in full recirculation mode and shall lower the space temperature to setpoint. Once the space reaches setpoint the unit shall shut off.

.13 Air Volume Control

.1 The supply air, return air and outside air volumes provided by this system are to be measured by air flow stations.

.2 Control the supply air static pressure 2/3 downstream in the supply duct initially at 250 Pa setpoint.

.3 The static pressure setpoint shall be reset by the Variable Air Volume requests for additional air. Refer to the variable air volume box control sequence for the method to reset the static pressure setpoint.

.4 Control the differential air quantity between the supply and return air by air flow measurement, to a setpoint established by the difference between fan volumes at design flow by adjusting the setting of the variable frequency drives.

.5 The minimum outside air flow rate will be maintained by maintaining the air flow station flow at setpoint.

.14 Air Flow Settings

Item	**Setpoint**
Maximum Supply Air	5663 lps
Maximum Return Air	5663 lps

1.4 AIR HANDLING UNIT AHU-24N (Cont'd)

.14 (Cont'd)

Item	Setpoint
Differential Between Supply and Return	0 lps - to be determined
Minimum Outside Air Setpoint	710 lps

.15 Humidity Control

.1 Humidity control shall consist of a direct injection steam humidifier connected to an electric steam generator. Each device shall have its own PID loop.

.2 The return air relative humidity shall be utilized to control the humidity within the space.

.3 Setpoint

.1 The low limit setpoint shall be set for 30% RH (operator adjustable).

.2

.4 Low Limit Setpoint Output

.1 When the relative humidity level is below the low limit setpoint modulate the control valve at the direct injection humidifier to maintain the exhaust air relative humidity at setpoint.

.2 If the supply air relative humidity is above 95% limit the humidifier control valve position to maintain this setpoint.

.3 If the air flow station is indicating that there is no supply air flow the humidifier steam control valve shall be locked in the 100% closed position.

.4 If the return air relative humidity is more than 5% below setpoint for a period of 20 minutes alarm at the EMCS.

.16 Temperature Control

.1 Temperature control shall be provided by a pumped chilled water cooling coil, pumped heating coil and free cooling dampers and hot water convectors.

.2 The supply air temperature shall be controlled between 11.7° C and 18.3°C.

.3 Cooling requests from the zone controllers will decrease the supply air temperature setpoint. The setpoint will be decreased as required to maintain a minimum of 11.7°C. The rate of change for the setpoint decrease will be 1°C every 10 minutes.

1.4 AIR HANDLING UNIT AHU-24N (Cont'd)

.16 (Cont'd)

.4 When no cooling requests are received from the zone controllers and heating requests are received from the applicable zone controllers the EMCS will increase the setpoint. The setpoint will be increased to a maximum 18.3 C. The rate of change for the setpoint increase will be 1°C every 10 minutes.

.5 When the supply air temperature is below setpoint all cooling commands (both valve & damper) will be reduced until they are zero. Once the cooling commands are at zero the heating valve will be modulated to maintain temperature. Note the EMCS will provide a 2°C deadband on the enabling of the heating valve.

.6 When the supply air temperature is above setpoint all heating commands will be reduced until they are zero. Once all heating commands are zero if the outside air temperature is less than 18.3°C , the EMCS will enable free cooling and modulate the exhaust air, mixed air and outdoor air dampers to maintain temperature. If free cooling is at maximum and/or unavailable the EMCS will modulate the cooling valve to maintain temperature. The cooling valve will be disabled when the outdoor air temperature is below 10°C . Note the EMCS will provide a 2°C deadband on the disabling of free cooling.

.7 If the supply air temperature is more than 5.5° C above or below setpoint for a period of 10 minutes alarm at the EMCS.

.8 If the supply air temperature drops below 7.2 °C alarm at the EMCS and initiate an automatic shut down.

.17 Chilled Water Cooling

.1 When the supply air temperature is above the supply air temperature setpoint the the coil pump shall be energized on and chilled water cooling coil control valve shall be modulated as required to maintain setpoint.

.2 The minimum supply air temperature shall be 11.7° C.

.3 The chilled water control valve shall be allowed to be manually overridden by the operator at the EMCS.

.18 Heating

.1 When the supply air temperature is below the supply air temperature setpoint the coil pump shall be energized on and heating coil

1.4 AIR HANDLING UNIT AHU-24N (Cont'd)

.18 (Cont'd)

.1 (Cont'd)
control valve shall be modulated as required to maintain setpoint.

.2 The maximum supply air temperature setpoint shall be 18.3° C.

.3 The heating coil control valve position shall be utilized for resetting the glycol supply temperature setpoint. If the valve is more than 85% open a request shall be sent to the heating control loop to raise the heating temperature setpoint. When the valve closes to its 75% open position the request for additional heat shall be disabled.

.4 The heating control valve shall be allowed to be manually overridden by the operator at the EMCS.

.19 Filters

.1 The pressure differential alarm across the following filters shall be monitored at the EMCS using a differential pressure sensor. The following filters shall be monitored.

.1 Merv 8

.2 Merv 13.

.2 The pressure differential shall be displayed on the system graphic.

.20 Trends

.1 The EMCS will continuously trend the following data:

.1 Supply air temperature.

.2 Return air temperature.

.3 Mixed air temperature.

.4 Status of Supply Fan and Return Fan.

.5 Space temperature (see plans for number).

.6 Return air relative humidity.

.7 Supply air static pressure.

.8 Filter differential pressure .

.21 System Graphics

.1 The system graphic will show the following:

.1 All of the above.

.2 Status of the unit (Running, Off, Auto Shutdown).

.3 Supply and Return air relative humidity.

.4 Supply air temperature setpoint, humidity setpoint and mode of operation of the unit.

1.4 AIR HANDLING UNIT AHU-24N (Cont'd)

.21 (Cont'd)
.1 (Cont'd)
.5 Status of low limit thermostat.
.6 Operating Condition for cooling coil control valves, heating control valves and humidity control valve.
.7 Space temperatures.

.22 Provide the monitoring and control points as listed on the point schedule.

1.5 CONTROL OF VAV TERMINAL BOX CONTROL SERVING OFFICE & MEETING ROOM SPACES

.1 General

.1 The VAV boxes maintain minimum air volumes to areas and provide a source of cooling for space temperature control.
.2 In some of the rooms perimeter radiation works in conjunction with the VAV box to provide heat for the space.
.3 Supply VAV box controls to VAV box manufacturer for factory mounting. The box manufacturer shall include factory mounting charges.

.2 Integration with Other Systems
.1 The VAV boxes run in conjunction with the air handling units and heating plant.
.2 Requests for additional cooling and heating will be sent to the air handling unit.

.3 Scheduling
.1 Occupied and unoccupied modes are determined by time of day schedules and/or occupancy sensors.

.4 Start Up
.1 During the occupied mode a run request is sent to the air handling unit and the VAV box is enabled to control temperature with occupied settings.

.5 Occupied Mode
.1 An electronic space temperature sensor and velocity pressure sensor shall operate through an individual stand alone DDC controller and

1.5 CONTROL OF VAV TERMINAL BOX CONTROL SERVING OFFICE & MEETING ROOM SPACES (Cont'd)

.5 (Cont'd)

.1 (Cont'd)
control space temperature by modulating the DDC VAV box actuator.

.2 Where VAV boxes have reheat coils or associated perimeter radiation the controller shall modulate the heating valve open on a call for heating after the VAV box is at minimum flow position

.3 Minimum and maximum air flow settings are indicated on the schedule.

.6 Load Reset

.1 Space temperatures are utilized in a load reset program.

.2 When any one VAV box is more than 95% of flow and the space temperature is at or above 24 deg C a request shall be sent to the air handling unit to reset the supply air temperature downwards. Once the VAV box drops to 90% of flow the request shall be disabled.

.3 When any one heating coil control valve for the perimeter radiation or the reheat coil is more than 90% open a heating request shall be sent to the boiler plant to increase the water supply temperature setpoint. Once the control valve has closed to the 80% open position the request shall be disabled.

.4 The EMCS shall monitor all of the VAV boxes in the system and it shall establish the minimum static pressure setpoint as the pressure required to ensure that at least one VAV box is at a minimum of 90% of flow in the system.

.7 Unoccupied Mode

.1 If the space temperature drops below 18°C the VAV controller will send a signal to the AHU to start. The VAV box will establish air flow at the minimum setpoint and request the unit provide a supply air suitable for heating. Once the space temperature rises above 20°C the VAV box will remove the run request. Once the air handling unit is turned off, the VAV will return to the unoccupied mode.

.2 If the space temperature rises above 27°C the VAV controller will send a signal to the AHU to start. The VAV box will establish air flow at the maximum setpoint and request the unit provide a supply air suitable for cooling. Once the space temperature drops below 25°C the VAV box will remove the run request. Once the air

1.5 CONTROL OF VAV TERMINAL BOX CONTROL SERVING OFFICE & MEETING ROOM SPACES (Cont'd)

.7 (Cont'd)
.2 (Cont'd)
handling unit is turned off, the VAV will return to the unoccupied mode.
.3 The velocity sensor input shall be automatically calibrated to its zero flow point once per day to ensure accuracy of flow sensing and elimination of need for calibration.

.8 Space Temperature Sensor
.1 The space temperature wall mount sensor shall have a blank cover and plug in jack for installation of hand held service module or laptop computer.
.2 Set up controls for 22C / 24C heating/cooling setpoints.

.9 Operator Interface
.1 The operator shall be able to adjust the following setpoints at the EMCS.
.2 Maximum CFM setpoint.
.3 Minimum CFM setpoint.
.4 Space Temperature setpoint.

.10 System Graphics
.1 The following shall be displayed on the system graphics for each box.
.2 Heating and Cooling Space temperature setpoint.
.1 The minimum, maximum and actual air flow setpoints.
.2 Actual Space temperature.
.3 Actual air flow.
.4 % open on the damper.
.5 Mode of operation for the box.

.11 System Shut-Down
.1 The terminal box system shall switch to unoccupied mode once the air handling unit serving the box is off.
.2 The box dampers shall go to their fully open position.
.3 Space temperature control shall continue to modulate associated perimeter radiation heating valves to maintain an unoccupied heating set point.

.12 Alarms
.1 HVAC General
.1 The space temperature drops below 15°C (10 minute delay).

(Cont'd)

.12 (Cont'd)
.1 (Cont'd)
.2 The space temperature rises above 28°C (10 minute delay).

.13 Trends
.1 The EMCS shall store the following continuous trends:
.1 Actual space temperature and air flow
.2 Space temperature and air flow setpoint.

1.6 ELECTRIC STEAM GENERATOR

.1 General
.1 The system serves the following systems: Humidification. . 1 Humidification.

.2 Scheduling
.1 The generator starts when there is a call for humdification system.

.3 System Start Up
.1 On system activation the steam generator shall be activated.
.2 If the generator fails to start, alarm at the EMCS.

.4 Monitoring
.1 Steam generator status.

.5 Alarms
.1 Generator failure

.6 Trends
.1 Boiler status and percent fire
.2 Natural gas usage for the boilers.
.3 Steam output capacity for each boiler.

1.7 ADJUSTMENTS SERVICE & WARRANTY

.1 Adjust and set thermostats, temperature sensors, humidity sensors, damper operators, relays and other components to proper settings to give required performance. Cooperate with other sections during testing and balancing of each mechanical system to ensure each total system operates to approval.

.2 Temperature control system shown and specified herein shall be warranted free from defects in materials and workmanship and shall be serviced

1.7 ADJUSTMENTS SERVICE & WARRANTY (Cont'd)

.2 (Cont'd)
without charge (except for damage from lack of maintenance of other causes) for one year after date of start of lien period. If, within this period, any equipment herein described is proved to be defective in workmanship or materials, it shall be replaced or repaired without charge.

.3 Sequencing of operations for systems as follows:
.1.

PART 2 - PRODUCTS

2.1 NOT USED

.1 Not Used.

PART 3 - EXECUTION

3.1 NOT USED

.1 Not Used.

END

PART 1 - GENERAL

1.1 REFERENCES

.1 Canadian Standards Association (CSA International)
.1 CSA-C22.1-12, Canadian Electrical Code, Part 1 Safety Standard for Electrical Installations.
.2 CAN3-C235 2010, Preferred Voltage Levels for AC Systems, 0 to 50,000 V.

.2 Health Canada / Workplace Hazardous Materials Information System (WHMIS)
.1 Material Safety Data Sheets (MSDS).

.3 The Ontario Electrical Safety Code, and all bulletins (Ontario).

.4 Electrical Safety Authority (ESA) requirements and local applicable codes and regulations.

1.2 DESIGN REQUIREMENTS

.1 Operating voltages: to CAN3-C235.

.2 Control and distribution devices and equipment to operate satisfactorily at 60 Hz within normal operating limits established by above standard.
.1 Equipment to operate in extreme operating conditions established in above standard without damage to equipment.

.3 Language operating requirements: provide identification nameplates and labels for control items in English.

1.3 SUBMITTALS

.1 Submittals: in accordance with Section 01 11 00.

.2 Product Data: submit WHMIS MSDS.

.3 Shop drawings:
.1 Submit drawings stamped and signed by professional engineer registered or licensed in Province of Ontario.
.2 Submit 6 number of copies of drawings and product data to authority having jurisdiction.
.3 If changes are required, notify Departmental Representative of these changes before they are made.

1.3 SUBMITTALS (Cont'd)

.4 Quality Control: in accordance with Section 01 11 00.
.1 Provide CSA certified equipment and material.
.2 Where CSA certified equipment and material is not available, submit such equipment and material to authority having jurisdiction for special approval before delivery to site.
.3 Submit test results of installed electrical systems and instrumentation.
.4 Permits and fees: in accordance with General Conditions of contract. Pay associated fees. Departmental Representative will provide drawings and specifications required by Electrical Inspection Department and Supply Authority at no cost.
.5 Submit, upon completion of Work, load balance report as described in PART 3 - Load Balance.
.6 Submit certificate of acceptance from Electrical Safety Authority having jurisdiction upon completion of Work to Departmental Representative.

1.4 QUALITY ASSURANCE

.1 Quality Assurance: in accordance with Section 01 11 00.

.2 Qualifications: electrical Work to be carried out by qualified, licensed electricians who hold valid Master Electrical Contractor license or apprentices as per the conditions of Provincial Act respecting manpower vocational training and qualification.
.1 Employees registered in provincial apprentices program: permitted, under direct supervision of qualified licensed electrician, to perform specific tasks.
.2 Permitted activities: determined based on training level attained and demonstration of ability to perform specific duties.

.3 Site Meetings:
.1 In accordance with Section 01 32 17 and Section 01 32 18.

.4 Health and Safety Requirements: do construction occupational health and safety in accordance with Section 01 35 29.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Material Delivery Schedule: provide Departmental Representative with schedule within 2 weeks after award of Contract.

.2 Construction/Demolition Waste Management and Disposal: separate waste materials for reuse and recycling in accordance with Section 01 11 01.

1.6 SYSTEM STARTUP

.1 Instruct Departmental Representative and operating personnel in operation, care and maintenance of systems, system equipment and components.

PART 2 - PRODUCTS

2.1 SUSTAINABLE REQUIREMENTS

.1 Materials and products in accordance with Section 01 11 00.

2.2 MATERIALS AND EQUIPMENT

.1 Provide material and equipment in accordance with Section 01 11 00.

.2 Material and equipment to be CSA certified. Where CSA certified material and equipment are not available, obtain special approval from authority having jurisdiction before delivery to site and submit such approval as described in PART 1 - Submittals.

.3 Factory assemble control panels and component assemblies.

2.3 WARNING SIGNS

.1 Warning signs: in accordance with requirements of authority having jurisdiction.

2.4 WIRING TERMINATIONS

.1 Ensure lugs, terminals, screws used for termination of wiring are suitable for either copper or aluminum conductors.

2.5 EQUIPMENT IDENTIFICATION

.1 Identify electrical equipment with nameplates and labels as follows:

.1 Nameplates: plastic laminate 3 mm thick plastic engraving sheet, matt white finish face, black core, mechanically attached with self tapping screws.

.2 Sizes as follows:

Size 1	10 x 50 mm	1 line	3 mm high letters
Size 2	12 x 70 mm	1 line	5 mm high letters
Size 3	12 x 70 mm	2 lines	3 mm high letters
Size 4	20 x 90 mm	1 line	8 mm high letters
Size 5	20 x 90 mm	2 lines	5 mm high letters
Size 6	25 x 100 mm	1 line	12 mm high letters
Size 7	25 x 100 mm	2 lines	6 mm high letters

.2 Labels: embossed plastic labels with 6 mm high letters unless specified otherwise. Colours: Clearly indicate the colour coding for regular power (black labels, white letters), Critical Power (blue labels, white letters), and Life Safety Power (red labels, white letters).

.3 Wording on nameplates and labels to be approved by Departmental Representative prior to manufacture.

.4 Allow for minimum of twenty-five (25) letters per nameplate and label.

.5 Nameplates for terminal cabinets and junction boxes to indicate system and/or voltage characteristics.

.6 Identify equipment with Size 3 labels engraved "ASSET INVENTORY No. " as directed by Departmental Representative.

.7 Disconnects, starters and contactors: indicate equipment being controlled and voltage.

.8 Terminal cabinets and pull boxes: indicate system and voltage.

.9 Transformers: indicate capacity, primary and secondary voltages.

2.6 WIRING IDENTIFICATION

.1 Identify wiring with permanent indelible identifying markings, coloured plastic tapes, on both ends of phase conductors of feeders and branch circuit wiring.

.2 Maintain phase sequence and colour coding throughout.

.3 Colour coding: to CSA-C22.1.

.4 Use colour coded wires in communication cables, matched throughout system.

2.7 CONDUIT AND CABLE IDENTIFICATION

.1 Colour code conduits, boxes and metallic sheathed cables.

.2 Code with plastic tape or paint at points where conduit or cable enters wall, ceiling, or floor, and at 15 m intervals.

.3 Colours: 25 mm wide prime colour and 20mm wide auxiliary colour.

	Prime	Auxiliary
up to 250 V	Yellow	
up to 600 V	Yellow	Green
Telephone	Green	
Other Communication Systems	Green	Blue
Fire Alarm	Red	
Emergency Voice	Red	Blue

2.8 FINISHES

.1 Shop finish metal enclosure surfaces by application of rust resistant primer inside and outside, and at least two coats of finish enamel.

2.9 DISTRIBUTION SYSTEM

.1 120/208V, 3 phase, 4W, 60 Hz.

.2 Inform other Divisions of electrical system characteristics.

2.10 WIRING SYSTEM

.1 Power and lighting circuits in EMT and/or described in other sections.

.2 Use heavy wall rigid conduit where required by codes.

.3 RW-90, XLPE insulated wire for panel feeder and branch circuits, GTF insulated wire for final fixture connection.

.4 #12 AWG minimum wire size, #10 AWG or larger shall be stranded.

.5 Copper conductors.

.6 Size branch circuits and panel feeders for maximum 2% voltage drop.

.7 Provide insulated green ground conductor in all EMT conduits.

.8 Provide nylon insulated bushings on the ends of all conduits in junction boxes, pullboxes, panelboards, etc.

.9 Minimum size conduit for lighting and power circuits is 21 mm.

2.11 GROUNDING

.1 Ground equipment with approved conductors and connectors.

.2 Make tests required by code and authorities having jurisdiction.

2.12 MOTOR AND CONTROL WIRING

.1 Provide wiring and connections for motors and electrical equipment supplied under other Divisions.

.2 Mechanical Divisions shall wire control circuits 50 volts and under.

2.13 PANELBOARD

.1 Provide panelboard of the circuit breaker type.

.2 Install branch circuit breakers shown on panel schedule.

.3 Panel to be in dead front metal cabinet with hinged door and catches.

2.13 PANELBOARD (Cont'd)

.4 Breakers: toggle type, bolt-on, quick-make, quick-break, 40°C ambient temperature compensated and trip-free of operating handles on overloads.

.5 Lock-on handle devices for breakers not controlling lighting. 2P and 3P breakers to be with single handle common trip type.

.6 Typed directory card showing load supplied by each circuit, mounted inside cabinet door.

.7 Mount panel at 1500 mm above finished floor with the top of panel not higher than 2000 mm.

.8 Copper bus with neutral of same ampere rating as mains.

.9 Provide two 27 mm spare empty conduits from recessed panels into ceiling space above panel and terminate in an accessible location.

2.14 OUTLET BOXES

.1 Light fixture outlet boxes: standard, octagonal or square as required.

.2 Switch outlet boxes: standard, single or ganged as required.

.3 Receptacle outlet boxes: standard.

.4 Steel construction.

.5 Standard FS conduit fittings for surface mounted outlets in exposed areas.

2.15 SWITCHES

.1 Specification grade, toggle type, 20 amps, 120V back and side wired, chrome plated yoke, silver cadmium oxide contacts, switch mechanism on neoprene cushion.

.2 Locate switches on latch side of door, 1.5 m above finished floor unless noted otherwise.

2.16 RECEPTACLES

.1 Specification grade, 15 amp, 125 volt, AC, 'U' ground parallel blade slots, triple wiping contacts, double grounding terminals, break- off feature for separate feeds, built-in strap in

2.16 RECEPTACLES (Cont'd)

.1 (Cont'd) plastic moulded body and back and side wiring terminals.

.2 Locate receptacles 400 mm above finished floor unless noted otherwise.

.3 Provide outlets with various configurations as indicated on electrical drawings.

2.17 COVER PLATES

.1 Common cover plate at ganged outlet boxes. Split plates not allowed.

2.18 FIXTURE MOUNTING

.1 Provide mounting and supports required for safe installation to Departmental Representative's satisfaction.

2.19 LIGHTING FIXTURES

.1 Provide lighting fixtures with lamps as illustrated in electrical standard details.

.2 Shop drawings to consist of catalogue cuts and photometric data from an independent test lab.

2.20 FLUORESCENT FIXTURES

.1 Ballast: electronic high power factor, energy saving type automatic resetting, thermal protection, pressure sensitive capacitor protection, lowest sound level available.

.2 Body: minimum 0.952 mm thick (20 gauge) steel, white baked enamel finish, reflectance value minimum 85%.

.3 Lens: 100% pure acrylic, low brightness, sparkling crystal prismatic pattern, maximum efficiency, and direct glare control. ULC certified.

.4 CSA rated for continuous row mounting.

2.21 LAMPS

.1 Fluorescent lamps: 1220 mm length unless specified otherwise, bi-pin, rapid start, premium grade, 18,000 hour life expectancy, 3,200 initial lumen output, cool/warm white.

2.22 DISCONNECT SWITCHES

.1 Heavy duty, quick-make, quick-break.

.2 Enclosure EEMAC 1R for interiors.

2.23 TELEPHONE SYSTEM

.1 Empty conduit system and outlets.

.2 E.M.T. conduit from terminal board/telephone closet to outlets unless indicated otherwise.

.3 Fish wire in each conduit.

.4 Co-ordinate with the Owner.

2.24 FIRE ALARM SYSTEMS

.1 Refer to Section 28 31 00.

2.25 DATA SYSTEM

.1 Empty conduit system and outlets.

.2 E.M.T. conduit from terminal board/data closet to outlets unless indicated otherwise.

.3 Fish wire in each conduit.

.4 Co-ordinate with the Owner.

END

PART 1 - GENERAL

1.1 REFERENCES

.1 CSA International
.1 CAN/CSA-C22.2 No.18, Outlet Boxes, Conduit Boxes and Fittings.
.2 CAN/CSA-C22.2 No.65, Wire Connectors (Tri-National Standard with UL 486A-486B and NMX-J-543-ANCE-03).

.2 National Electrical Manufacturers Association (NEMA)

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00.

.2 Product Data:
.1 Submit manufacturer's instructions, printed product literature and data sheets for wire and box connectors and include product characteristics, performance criteria, physical size, finish and limitations.

1.3 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00.

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

1.4 DELIVERY, STORAGE AND HANDLING

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

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

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

PART 2 - PRODUCTS

2.1 MATERIALS

.1 Pressure type wire connectors to: CAN/CSA-C22.2 No.65, with current carrying parts of copper sized to fit copper conductors as required.

.2 Fixture type splicing connectors to: CAN/CSA-C22.2 No.65, with current carrying parts of copper sized to fit copper conductors 10 AWG or less.

.3 Bushing stud connectors: to EEMAC 1Y-2 to consist of:
.1 Connector body and stud clamp for stranded copper conductors.
.2 Clamp for stranded copper conductors.
.3 Stud clamp bolts.
.4 Bolts for copper conductors.
.5 Sized for conductors as indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for wire and box connectors installation in accordance with manufacturer's written instructions.
.1 Visually inspect substrate in presence of Departmental Representative.
.2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 INSTALLATION

.1 Remove insulation carefully from ends of conductors and cables and:
.1 Apply coat of zinc joint compound on aluminum conductors prior to installation of connectors.
.2 Install mechanical pressure type connectors and tighten screws with appropriate compression tool recommended by manufacturer.

3.2 INSTALLATION (Cont'd)

.1 (Cont'd)

.2 (Cont'd)

Installation shall meet secureness tests in accordance with CAN/CSA-C22.2 No.65.

.3 Install fixture type connectors and tighten to CAN/CSA-C22.2 No.65. Replace insulating cap.

.4 Install bushing stud connectors in accordance with EEMAC 1Y-2.

3.3 CLEANING

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

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

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

.3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 21 and 01 35 21.

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

END

PART 1 - GENERAL

1.1 PRODUCT DATA

.1 Provide product data in accordance with Section 01 33 00.

1.2 DELIVERY, STORAGE AND HANDLING

.1 Packaging Waste Management: remove for reuse and return of packaging materials in accordance with Section 01 74 21.

PART 2 - PRODUCTS

2.1 BUILDING WIRES

.1 Where cables assemblies are specified to have a PVC overall covering it may be required to comply to the Vertical Tray Fire Test of CSA C22.2 No. 0.3 for the applicable Building Code classification of the project as it relates to the actual installed location.
.1 Conductors: stranded for 10 AWG and larger. Minimum size: 12 AWG.
.2 Copper conductors: size as indicated, with 600V insulation of cross-linked thermosetting polyethylene material rated RW90 or equal.

2.2 ARMOURED CABLES

.1 Conductors: insulated, copper size as indicated.

.2 Type: AC90.

.3 Armour: interlocking type fabricated from galvanized steel strip.

.4 Connectors: anti short connectors.

2.3 CONTROL CABLES

.1 Type: low energy 300 V control cable: stranded annealed copper conductors sized as indicated LVT: soft annealed copper conductors, sized as indicated:
.1 Insulation: TWH.
.2 Shielding: tape coated with paramagnetic material over each conductors.
.3 Overall covering: polyethylene jackets.

PART 3 - EXECUTION

3.1 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 01.

.2 Perform tests using method appropriate to site conditions and to approval of Departmental Representative and local authority having jurisdiction over installation.

.3 Perform tests before energizing electrical system.

3.2 GENERAL CABLE INSTALLATION

.1 Terminate cables in accordance with Section 26 05 20.

.2 Cable Colour Coding: to Section 26 05 01.

.3 Conductor length for parallel feeders to be identical.

.4 Lace or clip groups of feeder cables at distribution centres, pull boxes, and termination points.

.5 Wiring in walls: typically drop or loop vertically from above to better facilitate future renovations. Generally wiring from below and horizontal wiring in walls to be avoided unless indicated.

.6 Branch circuit wiring for surge suppression receptacles and permanently wired computer and electronic equipment to be 2-wire circuits only, i.e. common neutrals not permitted.

.7 Provide numbered wire collars for control wiring. Numbers to correspond to control shop drawing legend. Obtain wiring diagram for control wiring.

3.3 INSTALLATION OF BUILDING WIRES

.1 Install wiring as follows:
.1 In conduit systems in accordance with Section 26 05 34.

3.4 INSTALLATION OF ARMOURED CABLES

.1 Group cables wherever possible on channels.

3.5 INSTALLATION OF CONTROL CABLES

.1 Install control cables in conduit.

.2 Ground control cable shield.

END

PART 1 - GENERAL

1.1 SECTION INCLUDES

.1 Materials and installation for connectors and terminations.

1.2 RELATED SECTIONS

.1 Section 26 05 33 - Raceway and Boxes for Electrical Systems.

1.3 REFERENCES

.1 Canadian Standards Association
.1 CSA C22.2 No.41-07, Grounding and Bonding Equipment.

1.4 PRODUCT DATA

.1 Submit product data in accordance with Section 01 33 00.

1.5 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Section 01 74 21.

.2 Divert unused metal and wiring materials from landfill to metal recycling facility as approved by Departmental Representative.

PART 2 - PRODUCTS

2.1 CONNECTORS AND TERMINATIONS

.1 Copper compression connectors to CSA C22.2 as required sized for conductors.

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Bond and ground as required to CSA C22.2 No.41-07.

END

PART 1 - GENERAL

1.1 RELATED REQUIREMENTS

.1 Section 26 05 01.

1.2 REFERENCES

.1 American National Standards Institute /Institute of Electrical and Electronics Engineers (ANSI/IEEE)

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00.

.2 Product Data:
.1 Submit manufacturer's instructions, printed product literature and data sheets for grounding equipment and include product characteristics, performance criteria, physical size, finish and limitations.

1.4 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00.

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

1.5 DELIVERY, STORAGE AND HANDLING

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

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

.3 Storage and Handling Requirements:
.1 Store materials in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
.2 Store and protect grounding equipment.
.3 Replace defective or damaged materials with new.

PART 2 - PRODUCTS

2.1 EQUIPMENT

.1 Clamps for grounding of conductor: size as required to electrically conductive underground water pipe.

.2 Grounding conductors: bare stranded copper, soft annealed, size as required.

.3 Non-corroding accessories necessary for grounding system, type, size, material as indicated, including but not necessarily limited to:
- .1 Grounding and bonding bushings.
- .2 Protective type clamps.
- .3 Bolted type conductor connectors.
- .4 Thermit welded type conductor connectors.
- .5 Bonding jumpers, straps.
- .6 Pressure wire connectors.

PART 3 - EXECUTION

3.1 INSTALLATION GENERAL

.1 Install complete permanent, continuous grounding system including, electrodes, conductors, connectors, accessories. Where EMT is used, run ground wire in conduit.

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

.3 Protect exposed grounding conductors from mechanical injury.

.4 Use mechanical connectors for grounding connections to equipment provided with lugs.

.5 Soldered joints not permitted.

.6 Install bonding wire for flexible conduit, connected at both one ends to grounding bushing, solderless lug, clamp or cup washer and screw. Neatly cleat bonding wire to exterior of flexible conduit.

.7 Make grounding connections in radial configuration only, with connections terminating at single grounding point. Avoid loop connections.

3.1 INSTALLATION GENERAL (Cont'd)

.8 Bond single conductor, metallic armoured cables to cabinet at supply end, and provide non-metallic entry plate at load end.

3.2 EQUIPMENT GROUNDING

.1 Install grounding connections to typical equipment included in, but not necessarily limited to following list. Frames of motors, starters, control panels, panels.

3.3 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 01.

.2 Perform ground continuity and resistance tests using method appropriate to site conditions and to approval of Departmental Representative and local authority having jurisdiction over installation.

.3 Perform tests before energizing electrical system.

3.4 CLEANING

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

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

.3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 21.
.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END

PART 1 - GENERAL

1.1 WASTE MANAGEMENT AND DISPOSAL

.1 Remove from site and dispose of all packaging materials at appropriate recycling facilities.

.2 Collect and separate for disposal paper, plastic, polystyrene, corrugated cardboard, packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.

.3 Divert unused metal materials from landfill to metal recycling facility as approved by Departmental Representative.

.4 Fold up metal banding, flatten and place in designated area for recycling.

PART 2 - PRODUCTS

2.1 SUPPORT CHANNELS

.1 U shape, size 41 x 41 mm, 2.5 mm thick, surface mounted or suspended.

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Secure equipment to masonry, tile and plaster surfaces with lead anchors.

.2 Secure equipment to poured concrete with expandable inserts.

.3 Secure equipment to hollow masonry walls or suspended ceilings with toggle bolts.

.4 Secure surface mounted equipment with twist clip fasteners to inverted T bar ceilings. Ensure that T bars are adequately supported to carry weight of equipment specified before installation.

.5 Support equipment, conduit or cables using clips, spring loaded bolts, cable clamps designed as accessories to basic channel members.

3.1 INSTALLATION (Cont'd)

.6 Fasten exposed conduit or cables to building construction or support system using straps.
.1 One-hole malleable iron steel straps to secure surface conduits and cables 50 mm and smaller.
.2 Two-hole steel straps for conduits and cables larger than 50 mm.
.3 Beam clamps to secure conduit to exposed steel work.

.7 Suspended support systems.
.1 Support individual cable or conduit runs with 6 mm dia threaded rods and spring clips.
.2 Support 2 or more cables or conduits on channels supported by 6 mm dia threaded rod hangers where direct fastening to building construction is impractical.

.8 Provide metal brackets, frames, hangers, clamps and related types of support structures where indicated or as required to support conduit and cable runs.

.9 Ensure adequate support for raceways and cables dropped vertically to equipment where there is no wall support.

.10 Do not use wire lashing or perforated strap to support or secure raceways or cables.

.11 Do not use supports or equipment installed for other trades for conduit or cable support except with permission of other trade and approval of Departmental Representative.

.12 Install fastenings and supports as required for each type of equipment cables and conduits, and in accordance with manufacturer's installation recommendations.

END

PART 1 - GENERAL

1.1 REFERENCES

.1 Canadian Standards Association (CSA International)
.1 CSA C22.1-09, Canadian Electrical Code, Part 1.

1.2 SUBMITTALS

.1 Provide submittals in accordance with Section 01 11 00.

.2 Product Data:
.1 Provide manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.

1.3 DELIVERY, STORAGE AND HANDLING

.1 Waste Management and Disposal:
.1 Separate waste materials for reuse and recycling in accordance with Section 01 11 00 and 01 74 21.

PART 2 - PRODUCTS

2.1 JUNCTION AND PULL BOXES

.1 Construction: welded steel enclosure.

.2 Covers Flush Mounted: 25 mm minimum extension all around.

.3 Covers Surface Mounted: screw-on flat edge covers.

PART 3 - EXECUTION

3.1 SPLITTER INSTALLATION

.1 Mount plumb, true and square to building lines.

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

3.2 JUNCTION, PULL BOXES AND CABINETS INSTALLATION

.1 Install pull boxes in inconspicuous but accessible locations.

.2 Mount cabinets with top not higher than 2 m above finished floor except where indicated otherwise.

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

.4 Only main junction and pull boxes are indicated. Install additional pull boxes as required by CSA C22.1.

3.3 IDENTIFICATION

.1 Equipment Identification: to Section 26 05 01.

.2 Identification Labels: Size 2 nameplate.

END

PART 1 - GENERAL

1.1 REFERENCES

.1 Canadian Standards Association (CSA International)
.1 CSA C22.1-09, Canadian Electrical Code, Part 1.

1.2 SUBMITTALS

.1 Provide submittals in accordance with Section 01 11 00.

.2 Submit samples for floor box in accordance with Section 01 11 00.

1.3 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 11 00.

.2 Waste Management and Disposal:
.1 Separate waste materials for reuse and recycling in accordance with Section 01 74 21.

PART 2 - PRODUCTS

2.1 OUTLET AND CONDUIT BOXES GENERAL

.1 Size boxes in accordance with CSA C22.1.

.2 102 mm square or larger outlet boxes as required.

.3 Gang boxes where wiring devices are grouped.

.4 Blank cover plates for boxes without wiring devices.

.5 Combination boxes with barriers where outlets for more than one system are grouped.

2.2 GALVANIZED STEEL OUTLET BOXES

.1 One-piece electro-galvanized construction.

.2 Single and multi gang flush device boxes for flush installation, minimum size 76 x 50 x 38 mm or as indicated. 102 mm square outlet boxes when more than one conduit enters one side with extension and plaster rings as required.

2.2 GALVANIZED STEEL OUTLET BOXES (Cont'd)

.3 Utility boxes for outlets connected to surface-mounted EMT conduit, minimum size 102 x 54 x 48 mm.

.4 102 mm square or octagonal outlet boxes for lighting fixture outlets.

.5 Extension and plaster rings for flush mounting devices in finished walls.

2.3 CONDUIT BOXES

.1 Cast FS or FD boxes with factory-threaded hubs and mounting feet for surface wiring of devices.

2.4 FITTINGS - GENERAL

.1 Bushing and connectors with nylon insulated throats.

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

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

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

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Support boxes independently of connecting conduits.

.2 Fill boxes with paper, sponges or foam or similar approved material to prevent entry of debris during construction. Remove upon completion of work.

.3 For flush installations mount outlets flush with finished wall using plaster rings to permit wall finish to come within 6 mm of opening.

.4 Provide correct size of openings in boxes for conduit, mineral insulated and armoured cable connections. Do not install reducing washers.

.5 Vacuum clean interior of outlet boxes before installation of wiring devices.

.6 Identify systems for outlet boxes as required.

END

PART 1 - GENERAL

1.1 REFERENCES

.1 Canadian Standards Association (CSA International)
.1 CAN/CSA-C22.2 No. 18-2003, Outlet Boxes, Conduit Boxes, Fittings and Associated Hardware, A National Standard of Canada.
.2 CAN/CSA-C22.2 NO. 18.1-04, Metallic Outlet Boxes.
.3 CAN/CSA-C22.2 No. 18.3-2009,Conduit, Tubing, and Cable Fittings (Tri-National standard, with ANCE NMX-J-017 and UL 514B).
.4 CSA C22.2 No. 56-2009, Flexible Metal Conduit and Liquid-Tight Flexible Metal Conduit.
.5 CSA C22.2 No. 83-2008, Electrical Metallic Tubing.

1.2 SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00.

.2 Product data: submit manufacturer's printed product literature, specifications and datasheets.
.1 Submit cable manufacturing data.

.3 Quality assurance submittals:
.1 Test reports: submit certified test reports.
.2 Instructions: submit manufacturer's installation instructions.

1.3 WASTE MANAGEMENT AND DISPOSAL

.1 Separate waste materials for reuse and recycling in accordance with Section 01 74 21.

.2 Place materials defined as hazardous or toxic waste in designated containers.

.3 Ensure emptied containers are sealed and stored safely for disposal away from children.

PART 2 - PRODUCTS

2.1 CONDUITS

.1 Electrical metallic tubing (EMT): to CSA C22.2 No. 83, with couplings.

.2 Flexible metal conduit: to CSA C22.2 No. 56, liquid-tight flexible metal.

2.2 CONDUIT FASTENINGS

.1 One hole steel straps to secure surface conduits 50 mm and smaller.
.1 Two hole steel straps for conduits larger than 50 mm.

.2 Beam clamps to secure conduits to exposed steel work.

.3 Channel type supports for two or more conduits at 3 m on centre.

.4 Threaded rods, 6 mm diameter, to support suspended channels.

2.3 CONDUIT FITTINGS

.1 Fittings: to CAN/CSA C22.2 No. 18, manufactured for use with conduit specified. Coating: same as conduit.

.2 Ensure factory "ells" where 90 degrees bends for 25 mm and larger conduits.

.3 Watertight connectors and couplings for EMT.
.1 Set-screws are not acceptable.

2.4 EXPANSION FITTINGS FOR RIGID CONDUIT

.1 Weatherproof expansion fittings with internal bonding assembly suitable for 200 mm linear expansion.

.2 Watertight expansion fittings with integral bonding jumper suitable for linear expansion and 19 mm deflection.

.3 Weatherproof expansion fittings for linear expansion at entry to panel.

2.5 FISH CORD

.1 Polypropylene.

PART 3 - EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 INSTALLATION

.1 Install conduits to conserve headroom in exposed locations and cause minimum interference in spaces through which they pass.

.2 Conceal conduits except in mechanical and electrical service rooms and in unfinished areas.

.3 Surface mount conduits on existing concrete wall and columns.

.4 Use rigid galvanized steel threaded conduit except where specified otherwise.

.5 Use electrical metallic tubing (EMT) above 2.4 m not subject to mechanical injury.

.6 Use flexible metal conduit for connection to motors in dry areas connection to recessed fixtures without prewired outlet box connection to recessed fluorescent fixtures, work in movable metal partitions.

.7 Use liquid tight flexible metal conduit for connection to motors or vibrating equipment in damp, wet or corrosive locations.

.8 Install conduit sealing fittings in hazardous areas.
.1 Fill with compound.

.9 Minimum conduit size for lighting and power circuits: 19 mm.

.10 Bend conduit cold:
.1 Replace conduit if kinked or flattened more than 1/10th of its original diameter.

.11 Mechanically bend steel conduit over 19 mm diameter.

3.2 INSTALLATION (Cont'd)

.12 Field threads on rigid conduit must be of sufficient length to draw conduits up tight.

.13 Install fish cord in empty conduits.

.14 Run 2-25 mm spare conduits up to ceiling space and 2-25 mm spare conduits down to ceiling space from each flush panel.
.1 Terminate these conduits in 152 x 152 x 102 mm junction boxes in ceiling space or in case of an exposed concrete slab, terminate each conduit in surface type box.

.15 Remove and replace blocked conduit sections.
.1 Do not use liquids to clean out conduits.

.16 Dry conduits out before installing wire.

3.3 SURFACE CONDUITS

.1 Run parallel or perpendicular to building lines.

.2 Locate conduits behind infrared or gas fired heaters with 1.5 m clearance.

.3 Run conduits in flanged portion of structural steel.

.4 Group conduits wherever possible on suspended channels.

.5 Do not pass conduits through structural members except as indicated.

.6 Do not locate conduits less than 75 mm parallel to steam or hot water lines with minimum of 25 mm at crossovers.

3.4 CONCEALED CONDUITS

.1 Run parallel or perpendicular to building lines.

.2 Do not install horizontal runs in masonry walls.

.3 Do not install conduits in terrazzo or concrete toppings.

3.5 CLEANING

.1 Proceed in accordance with Section 01 74 11.

.2 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END

PART 1 - GENERAL

1.1 RELATED SECTIONS

.1 Section 26 05 01 - Common Work Results - Electrical

.2 Section 26 50 00 - Lighting.

1.2 REFERENCES

.1 Canadian Standards Association (CSA)
.1 CSA C22.2 No.184.1-2006, Solid-State Dimming Controls (Bi-national standard with UL 1472.

1.3 PRODUCT DATA

.1 Submit product data in accordance with Section 01 33 00.

.2 Submit WHMIS MSDS - Material Safety Data Sheets in accordance with Section 02 62 00.01.

.3 Submit product data sheets for fluorescent lighting control equipment. Include product characteristics, performance criteria, physical size, limitations and finish.

.4 Manufacturer's Instructions: Provide to indicate special handling criteria, installation sequence and cleaning procedures.

1.4 SHOP DRAWINGS

.1 Indicate shielded wiring requirements.

1.5 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Section 01 74 21.

.2 Place materials defined as hazardous or toxic waste in designated containers.

.3 Ensure emptied containers are sealed and stored safely for disposal away from children.

.4 Collect and separate plastic, paper packaging and corrugated cardboard in accordance with Waste Management Plan.

.5 Fold up metal banding, flatten and place in designated area for recycling.

PART 2 - PRODUCTS

2.1 EQUIPMENT - GENERAL

.1 Dimming system: to CSA C22.2 No.184.1, packaged in accordance with the Canadian Code for Preferred Packaging guidelines, components to be from one manufacturer, and to comprise an integrated system.

.2 System to start, and operate continuously, within intensity setting of 10 to 100%.

.3 System voltage as indicated.

2.2 ON-OFF SWITCH

.1 On-off switch mounted separately.

2.3 DIMMING AUXILIARIES

.1 Dimming auxiliaries, to control dimming ballasts, suitable for mounting in lighting fixture.

2.4 BALLASTS

.1 Section 26 50 00.

2.5 RELAYS, CONTACTORS

.1 Enclosed solid-state relays, contactors and controls for multipoint control.

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Install components comprising dimming system in accordance with manufacturer's instructions, and as indicated.

.2 Install wiring, shielding, grounding in accordance with manufacturer's instructions.

.3 Ensure shielded leads have outer insulating jackets and are connected to ground at one point only.

.4 Keep TV and intercom wiring a minimum of 1.8 m away from dimming circuitry. Where crossing of wiring is essential, ensure that grounded

3.1 INSTALLATION (Cont'd)

.4 (Cont'd)
shields surround such intercom wiring, and that crossings take place at 90°.

.5 Locate intensity controls and "on-off" switches as indicated.

.6 Ensure positive, low resistance lamp to pin contact within lampholder.

.7 Season lamps by operating at full intensity for 100 h prior to final inspection. Operate ballasts in ambient temperature above 18°C.

.8 Ensure connections are correctly made and to same phase before energizing.

3.2 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 00.

.2 Demonstrate that dimming systems are installed as indicated.

.3 Demonstrate that dimming systems operate as intended and that there are no problems in starting lamps, nor in keeping them lit, and free of perceptible flicker at any setting of dimming intensity control.

.4 Demonstrate that TV interference is carried by system and that there is no interference between dimming system and locally used infrared-based remote/integral controls.

END

PART 1 - GENERAL

1.1 SYSTEM DESCRIPTION

.1 Low voltage control system designed to provide remote switching of lighting loads by use of:
- .1 Low voltage momentary contact switches
- .2 Low voltage relays.
- .3 Control transformers
- .4 Low voltage rectifiers.

.2 Low voltage lighting control system shall be part of Delta DDC control and be connected to the existing Delta DDC control system by Delta Contractor.

1.2 SHOP DRAWINGS

.1 Submit shop drawings in accordance with Section 01 33 00.

1.3 CLOSEOUT SUBMITTALS

.1 Submit maintenance data in accordance with Section 01 78 00.

1.4 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Section 01 74 21, and with Waste Reduction Workplan.

.2 Place materials defined as hazardous or toxic waste in designated containers.

.3 Ensure emptied containers are sealed and stored safely for disposal away from children.

PART 2 - PRODUCTS

2.1 MATERIALS

.1 Control system: by one manufacturer and assembled from compatible components.

2.2 REMOTE CONTROL SWITCHES

.1 Single pole, double throw, momentary contact, standard duty, rated 20A, 25V, double push-button action.

2.3 CONTROL TRANSFORMER

.1 Low voltage power Class 2, input 120, AC, 60Hz, output 20VA at 24V.

2.4 MANUAL CONTROL

.1 Provide remote control switches as indicated.

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Locate and install equipment in accordance with manufacturer's recommendations and as indicated.

3.2 TESTS

.1 Perform tests in accordance with Section 26 05 01.

.2 Actuate control units in presence of Departmental Representative to demonstrate lighting circuits are controlled as designated.

END

PART 1 - GENERAL

1.1 REFERENCES

.1 CSA International
.1 CSA C22.2 No.29-11, Panelboards and Enclosed Panelboards.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00.

.2 Product Data:
.1 Submit manufacturer's instructions, printed product literature and data sheets for panelboards and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Shop Drawings:
.1 Submit drawings stamped and signed by professional engineer registered or licensed in Province of Ontario, Canada.
.2 Include on drawings:
.1 Electrical detail of panel, branch breaker type, quantity, ampacity and enclosure dimension.

1.3 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00.

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

1.4 DELIVERY, STORAGE AND HANDLING

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

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

.3 Storage and Handling Requirements:
.1 Store materials in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

1.4 DELIVERY, STORAGE AND HANDLING (Cont'd)

.3 Storage and Handling Requirements:(Cont'd)
.2 Store and protect panelboards from nicks, scratches, and blemishes.
.3 Replace defective or damaged materials with new.

PART 2 - PRODUCTS

2.1 PANELBOARDS

.1 Panelboards: to CSA C22.2 No.29 and product of one manufacturer.
.1 Install circuit breakers in panelboards before shipment.
.2 In addition to CSA requirements manufacturer's nameplate must show fault current that panel including breakers has been built to withstand.

.2 250V panelboards: bus and breakers rated for 10KA (symmetrical) interrupting capacity or as indicated.

.3 Sequence phase bussing with odd numbered breakers on left and even on right, with each breaker identified by permanent number identification as to circuit number and phase.

.4 Panelboards: mains, number of circuits, and number and size of branch circuit breakers as indicated.

.5 Minimum of 2 flush locks for each panel board.

.6 Two keys for each panelboard and key panelboards alike.

.7 Copper bus with neutral of double ampere rating of mains.

.8 Mains: suitable for bolt-on breakers.

.9 Trim with concealed front bolts and hinges.

.10 Trim and door finish: baked enamel.

2.2 BREAKERS

.1 Breakers: to Section 26 28 16.02.

.2 Breakers with thermal and magnetic tripping in panelboards except as indicated otherwise.

.3 Main breaker: separately mounted on top or bottom of panel to suit cable entry. When

2.2 BREAKERS (Cont'd)

.3 Main breaker:(Cont'd)
mounted vertically, down position should open breaker.

.4 Lock-on devices for exit and night light circuits.

2.3 EQUIPMENT IDENTIFICATION

.1 Provide equipment identification in accordance with Section 26 05 01.

.2 Nameplate for each panelboard Size 4 engraved.

.3 Nameplate for each circuit in distribution panelboards Size 2 engraved.

.4 Complete circuit directory with typewritten legend showing location and load of each circuit, mounted in plastic envelope at inside of panel door.

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Locate recessed panelboards as indicated and mount securely, plumb, true and square, to adjoining surfaces.

.2 Mount panelboards to height specified in Section 26 05 01 or as indicated.

.3 Connect loads to circuits.

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

3.2 CLEANING

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

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

.3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 21.

3.2 CLEANING (Cont'd)

.3 Waste Management:(Cont'd)

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

3.3 PROTECTION

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

.2 Repair damage to adjacent materials caused by panelboards installation.

END

PART 1 - GENERAL

1.1 REFERENCES

.1 CSA International
.1 CAN/CSA-C22.2 No.94.1-07, Enclosures for Electrical Equipment, Non Environment Considerations.

.2 National Electrical Manufacturers Association (NEMA)
.1 NEMA 250-2008, Enclosures for Electrical Equipment (1000 Volts Maximum).

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00.

.2 Product Data:
.1 Submit manufacturer's instructions, printed product literature and data sheets for electrical cabinets and enclosures and include product characteristics, performance criteria, physical size, finish and limitations.

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

1.3 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00.

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

1.4 DELIVERY, STORAGE AND HANDLING

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

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

.3 Storage and Handling Requirements:
.1 Store materials in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

1.4 DELIVERY, STORAGE AND HANDLING (Cont'd)

.3 Storage and Handling Requirements:(Cont'd)
.2 Store and protect electrical cabinets and enclosures from nicks, scratches, and blemishes.
.3 Replace defective or damaged materials with new.

PART 2 - PRODUCTS

2.1 MATERIALS

.1 Enclosure constructed with 2.7 mm thick minimum steel, with weather and corrosion resistant finish to CAN/CSA-C22.2 No. 94.1, Munsell Notation 7.5GY3.5/1.5, size as indicated.

.2 Entire enclosure to be capable of withstanding maximum impact force of 86 MN/m^2 area without rupture of material.

.3 Removable enclosure panels with formed edges, galvanized steel external fasteners removable only from inside enclosure.

.4 Equip enclosure with hot dipped galvanized mounting rails 1 m adjustable horizontally and vertically to enable mounting of equipment at any location within housing.
.1 Rails: 14 mm holes and 50 x 14 mm slots on 100 mm centres for horizontal adjustment.
.2 Holes in side panel flanges in 60 mm increments for vertical adjustment.

.5 Cover: tamperproof, bolt-on, domed to shed water.

.6 Door: 3 point latching, with padlocking means.

.7 Ventilation panel constructed to allow air circulation yet preventing entry of foreign objects, wild life, and vermin.

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Assemble enclosure in accordance with manufacturer's instructions and securely mount on building structure with channels, supports and fastenings.

.2 Mount equipment in enclosure.

.3 Label electrical cabinets and enclosure to Section 26 05 01.

3.2 CLEANING

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

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

.3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 21.
.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END

PART 1 - GENERAL

1.1 REFERENCES

.1 CSA International
.1 CSA C22.2 No.42-10, General Use Receptacles, Attachment Plugs and Similar Devices.
.2 CAN/CSA-C22.2 No.42.1-2009, Cover Plates for Flush-Mounted Wiring Devices (Bi-national standard, with UL 514D).
.3 CSA C22.2 No.55-2008, Special Use Switches.
.4 CSA C22.2 No.111-10, General-Use Snap Switches (Bi-national standard, with UL 20).

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00.

.2 Product Data:
.1 Submit manufacturer's instructions, printed product literature and data sheets for wiring devices and include product characteristics, performance criteria, physical size, finish and limitations.

1.3 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00.

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

1.4 DELIVERY, STORAGE AND HANDLING

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

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

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

PART 2 - PRODUCTS

2.1 SWITCHES

.1 15A, 120V, single pole, double pole, three-way, switches to: CSA C22.2 No.55 and CSA C22.2 No.111.

.2 Manually-operated general purpose AC 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 Ivory on drywall and Brown on existing concrete walls toggle.

.3 Toggle operated fully rated for tungsten filament, LED, and fluorescent lamps, and up to 80% of rated capacity of motor loads.

.4 Switches of one manufacturer throughout project.

2.2 RECEPTACLES

.1 Duplex receptacles, CSA type 5-15 R, 125 V, 15 A, U ground, to: CSA C22.2 No.42 with following features:
.1 Ivory urea moulded housing.
.2 Suitable for No. 10 AWG for back and side wiring.
.3 Break-off links for use as split receptacles.
.4 Eight back wired entrances, four side wiring screws.
.5 Triple wipe contacts and rivetted grounding contacts.

.2 Single receptacles CSA type 5-15 R, 125 V, 15 A, U ground with following features:
.1 Ivory in drywalls and Brown in concrete walls urea moulded housing.
.2 Suitable for No. 10 AWG for back and side wiring.
.3 Four back wired entrances, 2 side wiring screws.

.3 Other receptacles with ampacity and voltage as indicated.

2.2 RECEPTACLES (Cont'd)

.4 Receptacles of one manufacturer throughout project.

2.3 COVER PLATES

.1 Cover plates for wiring devices to: CSA C22.2 No.42.1.

.2 Sheet steel utility box cover for wiring devices installed in surface-mounted utility boxes.

.3 Stainless steel, vertically brushed, 1 mm thick cover plates for wiring devices mounted in flush-mounted outlet box.

.4 Sheet metal cover plates for wiring devices mounted in surface-mounted FS or FD type conduit boxes.

2.4 SOURCE QUALITY CONTROL

.1 Cover plates from one manufacturer throughout project.

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Switches:
.1 Install single throw switches with handle in "UP" position when switch closed.
.2 Install switches in gang type outlet box when more than one switch is required in one location.
.3 Mount toggle switches at height in accordance with Section 26 05 01.

.2 Receptacles:
.1 Install receptacles in gang type outlet box when more than one receptacle is required in one location.
.2 Mount receptacles at height in accordance with Section 26 05 01.
.3 Where split receptacle has one portion switched, mount vertically and switch upper portion.
.4 Install GFI type receptacles as indicated.

.3 Cover plates:
.1 Install suitable common cover plates where wiring devices are grouped.

3.1 INSTALLATION (Cont'd)

.3 Cover plates:(Cont'd)
.2 Do not use cover plates meant for flush outlet boxes on surface-mounted boxes.

3.2 CLEANING

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

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

.3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 21.
.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.3 PROTECTION

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

.2 Protect stainless steel cover plate finish with paper or plastic film until painting and other work is finished.

.3 Repair damage to adjacent materials caused by wiring device installation.

END

PART 1 - GENERAL

1.1 REFERENCES

.1 CSA International (CSA)
.1 CSA C22.2 No. 5-09, Molded-Case Circuit Breakers, Molded-Case Switches and Circuit-Breaker Enclosures (Tri-national standard with UL 489, and NMX-J-266-ANCE-2010).

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00.

.2 Product Data:
.1 Submit manufacturer's instructions, printed product literature and data sheets for circuit breakers and include product characteristics, performance criteria, physical size, finish and limitations.

1.3 DELIVERY, STORAGE AND HANDLING

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

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

.3 Storage and Handling Requirements:
.1 Store circuit breakers in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
.2 Store and protect circuit breakers.
.3 Replace defective or damaged materials with new.

PART 2 - PRODUCTS

2.1 BREAKERS GENERAL

.1 Moulded-case circuit breakers, and ground-fault circuit-interrupters: to CSA C22.2 No. 5.

.2 Bolt-on moulded case circuit breaker: quick-make, quick-break type, for manual and automatic operation with temperature compensation for 40 degrees C ambient.

2.2 THERMAL MAGNETIC BREAKERS DESIGN A

.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 ENCLOSURE

.1 Sprinkler-proof: NEMA 1R.

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Install circuit breakers as required.

3.2 CLEANING

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

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

.3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 21.
.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END

PART 1 - GENERAL

1.1 PRODUCT DATA

.1 Submit product data in accordance with Section 01 33 00.

1.2 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Section 01 74 21.

PART 2 - PRODUCTS

2.1 DISCONNECT SWITCHES

.1 Non-fusible, disconnect switch in CSA Enclosure 1R, size as indicated.

.2 Provision for padlocking in off switch position by locks.

.3 Mechanically interlocked door to prevent opening when handle in ON position.

.4 Quick-make, quick-break action.

.5 ON-OFF switch position indication on switch enclosure cover.

2.2 EQUIPMENT IDENTIFICATION

.1 Provide equipment identification in accordance with Section 26 05 01.

.2 Indicate name of load controlled on Size 4 nameplate.

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Install disconnect switches.

END

PART 1 - GENERAL

1.1 REFERENCES

.1 International Electrotechnical Commission (IEC)
.1 IEC 60947-4-1-2009, Low-voltage switchgear and controlgear - Part 4-1: Contactors and motor-starters - Electromechanical contactors and motor-starters.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00.

.2 Product Data:
.1 Provide manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Shop Drawings:
.1 Provide shop drawings: in accordance with Section 01 33 00.
.1 Submit drawings stamped and signed by professional engineer registered or licensed in Province of Ontario, Canada.
.2 Provide shop drawings for each type of starter to indicate:
.1 Mounting method and dimensions.
.2 Starter size and type.
.3 Layout and components.
.4 Enclosure types.
.5 Wiring diagram.
.6 Interconnection diagrams.

1.3 CLOSEOUT SUBMITTALS

.1 Provide maintenance materials in accordance with Section 01 78 00.

.2 Submit operation and maintenance data for each type and style of motorstarter for incorporation into maintenance manual.

.3 Extra Materials:
.1 Provide listed spare parts for each different size and type of starter.
.1 3 contacts, stationary.
.2 3 contacts, movable.
.3 1 contacts, auxiliary.
.4 1 control transformers.
.5 1 operating coil.
.6 2 fuses.

1.3 CLOSEOUT SUBMITTALS (Cont'd)

.3 Extra Materials:(Cont'd)
.1 (Cont'd)
.7 10 % indicating lamp bulbs used.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle in accordance with Section 01 61 00.

.2 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.

.3 Packaging Waste Management: remove for reuse and return by manufacturer of pallets crates paddling and packaging materials in accordance with Section 01 74 21.

PART 2 - PRODUCTS

2.1 MATERIALS

.1 Starters: to IEC 60947-4-1 with AC4 utilization category.

2.2 FULL VOLTAGE MAGNETIC STARTERS

.1 Magnetic and combination magnetic starters of size, type, rating and enclosure type as indicated with components as follows:
.1 Contactor solenoid operated, rapid action type.
.2 Motor overload protective device in each phase, manually reset from outside enclosure.
.3 Wiring and schematic diagram inside starter enclosure in visible location.
.4 Identify each wire and terminal for external connections, within starter, with permanent number marking identical to diagram.

.2 Combination type starters to include fused disconnect switch motor circuit interrupter circuit breaker with operating lever on outside of enclosure to control disconnect motor circuit interrupter circuit breaker, and provision for:
.1 Locking in "OFF" position with up to 3 padlocks.
.2 Independent locking of enclosure door.
.3 Provision for preventing switching to "ON" position while enclosure door open.

2.2 FULL VOLTAGE MAGNETIC STARTERS (Cont'd)

.3 Accessories:
.1 Pushbuttons Selector switches: standard heavy duty oil tight labelled as indicated.
.2 Indicating lights: standard heavy duty oil tight type and color as indicated.
.3 1-N/O and 1-N/C spare auxiliary contacts unless otherwise indicated.

2.3 CONTROL TRANSFORMER

.1 Single phase, dry type, control transformer with primary voltage as indicated and 120V secondary, complete with secondary fuse, installed in with starter as indicated.

.2 Size control transformer for control circuit load plus 20% spare capacity.

2.4 ACCESSORIES

.1 Pushbutton: heavy duty, oil tight as required.

.2 Selector switches: heavy duty, oil tight as required.

.3 Indicating lights: heavy duty, oil tight, type and colour as indicated.

2.5 FINISHES

.1 Apply finishes to enclosure in accordance with Section 26 05 01.

2.6 EQUIPMENT IDENTIFICATION

.1 Provide equipment identification in accordance with Section 26 05 01.

.2 Magnetic starter designation label, white plate, black letters, size as required engraved as indicated.

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Install starters and control devices in accordance with manufacturer's instructions.

.2 Install and wire starters and controls as indicated.

.3 Ensure correct fuses installed.

.4 Confirm motor nameplate and adjust overload device to suit.

3.2 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 01 and manufacturer's instructions.

.2 Operate switches and contactors to verify correct functioning.

.3 Perform starting and stopping sequences of contactors and relays.

.4 Check that sequence controls, interlocking with other separate related starters, equipment, control devices, operate as indicated.

3.3 CLEANING

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

.2 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 21.

END

PART 1 - GENERAL

1.1 REFERENCES

.1 American National Standards Institute (ANSI)
.1 ANSI C82.1-2004, American National Standard for Lamp Ballasts - Line Frequency Fluorescent Lamp Ballasts.

.2 American National Standards Institute/Institute of Electrical and Electronics Engineers (ANSI/IEEE)
.1 ANSI/IEEE C62.41-1991, Recommended Practice for Surge Voltages in Low-Voltage AC Power Circuits.

.3 ASTM International Inc.
.1 ASTM F1137-00 (2006), Standard Specification for Phosphate/Oil and Phosphate/Organic Corrosion Protective Coatings for Fasteners.

.4 Canadian Standards Association (CSA International)

.5 ICES-005-07, Radio Frequency Lighting Devices.

.6 Underwriters' Laboratories of Canada (ULC)

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00.

.2 Product Data:
.1 Provide manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.
.2 Provide complete photometric data prepared by independent testing laboratory for luminaires where specified, for review by Departmental Representative.
.3 Photometric data to include:

.3 Quality assurance submittals: provide following in accordance with Section 01 45 00.
.1 Manufacturer's instructions: provide manufacturer's written installation instructions and special handling criteria, installation sequence and cleaning procedures.

1.3 QUALITY ASSURANCE

.1 Provide mock-ups in accordance with Section 01 45 00.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00.

.2 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.

.3 Packaging Waste Management: remove for reuse and return of pallets and packaging materials in accordance with Section 01 74 21.

.4 Divert unused metal materials from landfill to metal recycling facility.

.5 Disposal and recycling of fluorescent lamps as per local regulations.

PART 2 - PRODUCTS

2.1 LAMPS

.1 Fluorescent lamps to be - T5, 28W or T5HO, 54W bi-pin, rapid-start, 4100K, 30,000 hour lamp life, 2850 initial lumens, CRI 82; or as indicated.

.2 Fluorescent lamps to be - T8, 32 Watt, medium bi-pin, rapid-start, 4100K, 30,000 hour lamp life, 2950 initial lumens, CRI 85; or as indicated.

.3 LED lamp to be 5 minimum 50,000 hour lamp life, 4100K, CRI 75.

2.2 BALLASTS

.1 Fluorescent ballast: CBM and CSA certified, energy efficient type, IC electronic and/or IC electronic dimmable.
.1 Rating: 60 Hz voltage as indicated, for use with 2-32W, rapid start lamps or as indicated.
.2 Totally encased and designed for 40 degrees Celsius ambient temperature.
.3 Power factor: minimum 95% with 95% of rated lamp lumens.
.4 Current crest factor: 1.4 maximum.
.5 Harmonics: 10% maximum THD.

2.2 BALLASTS (Cont'd)

.1 (Cont'd)
.6 Operating frequency of electronic ballast: 20kHz minimum.
.7 Total circuit power: 62 Watts.
.8 Ballast factor: greater than 0.95.
.9 Sound rated: Class A.
.10 Mounting: integral with luminaire.

2.3 FINISHES

.1 Light fixture finish and construction to meet ULC listings and CSA certifications related to intended installation.

2.4 OPTICAL CONTROL DEVICES

.1 As indicated in luminaire schedule.

2.5 LUMINAIRES

.1 As indicated in luminaire schedule on the electrical drawing.

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Locate and install luminaires as indicated.

.2 Provide adequate support to suit ceiling system.

3.2 WIRING

.1 Connect luminaires to lighting circuits:
.1 Install flexible or rigid conduit for luminaires as indicated.

3.3 LUMINAIRE SUPPORTS

.1 For suspended ceiling installations support luminaires independently of ceiling.

3.4 LUMINAIRE ALIGNMENT

.1 Align luminaires mounted in continuous rows to form straight uninterrupted line.

.2 Align luminaires mounted individually parallel or perpendicular to building grid lines.

3.5 CLEANING

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

.2 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 21.

END

PART 1 - GENERAL

1.1 REFERENCES

.1 Canadian Standards Association (CSA International)
.1 CSA C22.2 No.141-10, Unit Equipment for Emergency Lighting.
.2 CAN/CSA-C860-07, Performance of Internally Lighted Exit Signs.

.2 National Fire Protection Association (NFPA)
.1 NFPA 101-2009, Life Safety Code.

.3 Underwriters Laboratories of Canada (ULC)
.1 ULC/ORD-924-02, Standard for Emergency Lighting and Power Equipment.
.2 CAN/ULC-S572-10, First Edition Standard for Photoluminescent and Self-Luminous Exit Signs and Path Marking Systems.

1.2 SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00.

.2 Product Data:
.1 Submit manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Submit WHMIS MSDS - Material Safety Data Sheets.

.4 Quality Assurance Submittals: submit following in accordance with Section 01 45 00.
.1 Instructions: submit manufacturer's installation instructions and special handling criteria, installation sequence and cleaning procedures.

.5 Submit manufacturer's written material warranty for lumination of photo-luminescent exit signs. For the Work of this Section 26 53 00 - Exit Lights, the 12 months warranty period prescribed in subsection GC 3.13 of General Conditions is extended to 25 years.

1.3 WASTE MANAGEMENT AND DISPOSAL

.1 Separate waste materials for reuse and recycling in accordance with Section 01 74 21.

PART 2 - PRODUCTS

2.1 STANDARD UNITS

.1 Exit lights: to CSA C22.2 No.141 and CSA C860.

.2 Housing: Die-cast aluminum semi-recessed back box for mounting on ceiling and/or wall.

.3 Face and back plates: Clear acrylic panel with pictogram legend.

.4 Lamps: one strip LED-2.5W module 120V, 50,000 hours.

.5 Operation: designed for 50,000 hours of continuous operation without relamping.

.6 Downlight: translucent acrylic in bottom of unit.

.7 Face plate to remain captive for relamping.

2.2 DESIGN X1

.1 Ceiling recessed mounting.

.2 Double face with edge-lit face plate to remain captive for relamping.

.3 Arrow: See drawing for detail.

PART 3 - EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 INSTALLATION

.1 Install exit lights to manufacturer's recommendations, listing requirements, NFPA standard and local regulatory requirements.

.2 Connect fixtures to exit light circuits.

3.2 INSTALLATION (Cont'd)

.3 Ensure that exit light circuit breaker is locked in on position.

3.3 CLEANING

.1 Proceed in accordance with Section 01 74 11.

.2 Clean photoluminescent sign face with a non-abrasive cloth dampened with water. Do not use any chemical solvents.

.3 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END

Section	Title	Pages
Division 27 - Communications		
27 05 28	PATHWAYS FOR COMMUNICATIONS SYSTEMS	2

END

PART 1 - GENERAL

1.1 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00.

.2 Product Data:
.1 Submit manufacturer's instructions, printed product literature and data sheets for communication raceway systems and include product characteristics, performance criteria, physical size, finish and limitations.

1.2 DELIVERY, STORAGE AND HANDLING

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

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

.3 Storage and Handling Requirements:
.1 Store materials in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
.2 Store and protect communication raceway systems.
.3 Replace defective or damaged materials with new.

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

.1 Empty telecommunications raceways system consists of outlet boxes, cover plates, cabinets, conduits, cable trays, pull boxes, sleeves and caps, fish wires, etc.

.2 Overhead distribution system.

2.2 MATERIAL

.1 Conduits: in accordance with Section 26 05 34.

.2 Junction boxes, cabinets type E and T: in accordance with Section 26 05 31.

.3 Outlet boxes, conduit boxes, and fittings: in accordance with Section 26 05 31.

2.2 MATERIAL (Cont'd)

.4 Fish wire: polypropylene type.

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Install empty raceway system, including underfloor overhead distribution system, fish wire, terminal cabinets, outlet boxes, floor boxes, pull boxes, cover plates, conduit, sleeves and caps, cable tray, service poles, miscellaneous and positioning material to constitute complete system.

3.2 CLEANING

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

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

.3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 21.
.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.3 PROTECTION

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

.2 Repair damage to adjacent materials caused by pathways for communications systems installation.

END

Section	Title	Pages
Division 28 - Electronic Safety and Security		
28 31 00	FIRE DETECTION AND ALARM	11

END

PART 1 - GENERAL

1.1 SUMMARY

.1 Section Includes:

.1 Materials and installation for fire alarm systems.

.2 Description of control panel and any required modifications to facilitate the renovation to carry out fire alarm and protection functions including receiving alarm signals, initiating general two-stage alarm, supervising system continuously, actuating zone annunciators, and initiating trouble signals.

.3 Update FACP, annunciator(s) and active graphic on fire alarm PC to reflect all the changes under this renovation.

.1 Trouble signal devices

.2 Power supply facilities.

.3 Manual alarm stations.

.4 Automatic alarm initiating devices.

.5 Audible signal devices.

.6 End-of-line devices.

.7 Annunciators.

.8 Visual alarm signal devices.

.9 Ancillary devices.

.2 Related Sections:

.1 Section 26 05 01.

1.2 REFERENCES

.1 Underwriter's Laboratories of Canada (ULC)

.1 CAN/ULC-S524-06, Standard for the Installation of Fire Alarm Systems.

.2 CAN/ULC-S525-07, Audible Signal Device for Fire Alarm Systems.

.3 CAN/ULC-S526-07, Visual Signal Devices for Fire Alarm Systems.

.4 CAN/ULC-S528-05, Manual Pull Stations for Fire Alarm Systems.

.5 CAN/ULC-S529-09, Smoke Detectors for Fire Alarm Systems.

.6 CAN/ULC-S530-M91, Heat Actuated Fire Detectors for Fire Alarm Systems.

.7 CAN/ULC-S1001-11, Standard for Integrated Systems Testing of Fire Protection and Life Safety Systems.

1.3 SUBMITTALS

.1 Product Data:
.1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 33 00.
.1 Submit two copies of Workplace Hazardous Materials Information System (WHMIS) Material Safety Data Sheets (MSDS) in accordance with Section 01 33 00.

.2 Shop Drawings:
.1 Submit shop drawings in accordance with Section 01 33 00.
.1 Shop drawings: stamped and signed by professional engineer registered or licensed in Province s of Ontario, Canada.
.2 Include:
.1 Layout of equipment.
.2 Zoning.
.3 Complete wiring diagram, including schematics of modules.

.3 Quality assurance submittals: submit following in accordance with Section 01 33 00.
.1 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
.2 Instructions: submit manufacturer's installation instructions.
.3 Manufacturer's Field Reports: manufacturer's field reports specified.

.4 Closeout Submittals:
.1 Submit maintenance and engineering data for incorporation into manual specified in Section 01 78 00 in accordance with ANSI/NFP A 20.
.2 Authority of Jurisdiction will delegate authority for review and approval of submittals required by this Section.
.3 Submit to Authority of Jurisdiction 2 sets of approved submittals and drawings immediately after approval but no later than 15 working days to prior to final inspection.
.4 Submit following:
.1 Manufacturer's Data for:
.1 Manual pull stations.
.2 Heat detectors.
.3 Open-area smoke detectors.
.4 Alarm bells with recessed box and grille to match existing.
.5 Visible appliances.

1.3 SUBMITTALS (Cont'd)

.4 Closeout Submittals:(Cont'd)
.4 Submit following:(Cont'd)

.6 Mark data which describe more than one type of item to indicate which type will be provided.
.7 Submit 1 original for each item and clear, legible, first-generation photocopies for remainder of specified copies.

.2 System wiring diagrams:
.1 Submit complete wiring diagrams of system showing points of connection and terminals used for electrical connections in the system.

.3 Design data: Power Calculations:
.1 Submit design calculations for new work specified to substantiate that battery capacity exceeds supervisory and alarm power requirements.

.4 Schedules:
.1 Conductor wire marker schedule.

.5 Test Reports:
.1 Open-area 2-wire smoke detectors.
.2 Preliminary testing:
.1 Final acceptance testing.
.2 Submit for inspections and tests specified under Field Quality Control.

1.4 QUALITY ASSURANCE

.1 Qualifications:
.1 Installer: company or person specializing in fire alarm system installations with 5 -years documented experience approved by manufacturer.

.2 Provide services of representative or technician from manufacturer of system, experienced in installation and operation of type of system being provided, to supervise installation, adjustment, preliminary testing, and final testing of system and to provide instruction to project personnel.

.3 Extra Materials:
.1 Provide maintenance materials in accordance with Section 01 78 00.

.4 Maintenance Service:
.1 Provide one year's free maintenance with two inspections by manufacturer during warranty

1.4 QUALITY ASSURANCE (Cont'd)

.4 Maintenance Service:(Cont'd)
.1 (Cont'd)
period. Inspection tests to conform to CAN/ULC- S536. Submit inspection report to Departmental Representative.

1.5 DELIVERY, STORAGE, AND HANDLING

.1 Packing, shipping, handling and unloading:
.1 Deliver, store and handle in accordance with Section 01 61 00.
.2 Deliver, store and handle materials in accordance with manufacturer's written instructions.

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

PART 2 - PRODUCTS

2.1 SUSTAINABLE REQUIREMENTS

.1 Materials and products in accordance with Section 01 47 15.

2.2 MATERIALS

.1 Equipment and devices: ULC listed and labelled and supplied by single manufacturer.

.2 Audible signal devices: to CAN/ULC-S525.

.3 Visual signal devices: to CAN/ULC-S526.

.4 Thermal detectors: to CAN/ULC-S530.

.5 Smoke detectors: to CAN/ULC-S529.

2.3 SYSTEM OPERATION

.1 Two stage operation: operation to actuation following:
.1 Manual station.
.2 Heat detector.
.3 Smoke detector.

.2 Actuation of two stage operation device to initiate following:
.1 Audible signal devices throughout building to sound at 20 strokes per minute.

2.3 SYSTEM OPERATION (Cont'd)

.2 (Cont'd)

.2 Audible signal devices in zone of alarm and adjacent zones on same floor level zones on floor level immediately above and floor level immediately below to sound continuously while other audible signal devices throughout building sound at 20 strokes per minute.

.3 Zone of alarm to be indicated on control panel and remote annunciator.

.4 Transmit signal to fire department via fire alarm transmitter monitoring station.

.5 Air conditioning and ventilating fans to shut down or to function so as to provide required control of smoke movement.

.6 Fire doors and smoke control doors if normally held open, to close automatically.

.7 Electro-magnetic door holders to de-energize.

.8 Operations to remain in alarm mode (except alarm notification appliances if manually silenced) until system is manually restored to normal.

.3 Operation of alarm initiating device on second stage to:

.1 Cause audible signal devices throughout building to sound continuously.

.4 Capability to program smoke detector status change confirmation on any or zones in accordance with CAN/ULC-S527.

2.4 CONTROL PANEL

.1 Existing control panel to remain. Modify as required to suit the renovation.

.2 Two stage operation.

.3 Zoned Non-zoned.

2.5 AUTOMATIC ALARM INITIATING DEVICES

.1 Heat detectors: provide heat detectors as indicated designed for detection of fire by combination fixed temperature rate-of-rise rate compensating line-type fixed temperature principle.

.2 Open-Area Smoke Detectors: provide detectors designed for detection of abnormal smoke densities by photoelectric principle.

.1 Detectors: 4-wire type.

2.5 AUTOMATIC ALARM INITIATING DEVICES (Cont'd)

.2 Open-Area Smoke Detectors:(Cont'd)

.2 Provide necessary control and power modules required for operation integral with control panel.

.3 Detectors and associated modules: compatible with control panel and suitable for use in supervised circuit.

.4 Malfunction of electrical circuits to detector or its control or power units to result in operation of system trouble signals.

.5 Equip each detector with visible indicator lamp that will flash when detector is in normal standby mode and glow continuously when detector is activated.

.6 Provide remote indicator lamps for each detector that is locatedabove suspended ceilings, beneath raised floors, concealed from view.

.7 Each detector: plug-in type with tab-lock or twist-lock, quick disconnect head and separate base in which detector base contains screw terminals for making wiring connections.

.8 Detector head: removable from its base without disconnecting wires. Removal of detector head from its base to cause activation of system trouble signals.

.9 Screen each detector to prevent entrance of insects into detection chamber(s).

.3 Photoelectric Detectors: operate on light scattering principle using LED light source.

.1 Detector: respond to both flaming and smoldering fires.

.4 Locate detectors in accordance with their listing by ULC and the requirements of NFPA 72, except provide at least 2 detectors in rooms of 54 square meters or larger in area.

.5 Mount detectors at underside of ceiling or deck above unless otherwise indicated.

.1 For mounting heights greater than 3 m above floor level, reduce actual detector linear spacing from listed spacing as required by NFPA 72.

.2 For heights greater than 9 m space detectors no farther apart than 34 % of their listed spacing.

.6 Temperature rating of detectors: in accordance with NFPA 72.

2.5 AUTOMATIC ALARM INITIATING DEVICES (Cont'd)

.7 Locate detectors minimum 300 mm to lighting fixtures and not closer than 600 mm to air supply or return diffuser.

.8 Ensure detectors, located in areas subject to moisture or exterior atmospheric conditions or hazardous locations as defined by NFPA 70, are approved for such locations.

.9 Provide detectors with terminal screw type connections.

.10 Removal of detector head from its base to cause activation of system trouble signals if detectors are provided with separable heads and bases.

2.6 ALARM INITIATING DEVICE SPACING AND LOCATION

.1 Detector spacing and location: in accordance with manufacturer's recommendations and requirements of NFPA 72.

.2 Provide at least 2 detectors in rooms of 54 square meters or larger.

.3 Spacing: not to exceed 9 m by 9 m per detector, and 9 linear m per detector along corridors.

.4 Locate detectors minimum 0.9 from air discharge or return grille, and not closer than 300 mm to lighting fixtures.

.5 In areas without finished ceilings, mount detectors at underside of deck above unless otherwise indicated.

2.7 AUDIBLE SIGNAL DEVICES

.1 Audible device(s):
.1 Bells: recessed mounted, single stroke, polarized, 24 V dc, 150 mm, 95db.

.2 Do not exceed 80 percent of listed rating in amperes of notification appliance circuit. Provide additional circuits above those shown if required to meet this requirement.

.3 Provide appliances specifically listed for outdoor use in locations exposed to weather.

.4 Finish appliances in red enamel.

2.7 AUDIBLE SIGNAL DEVICES (Cont'd)

.5 For surface mounting provide appliance manufacturer's approved back box. Back box finish to match appliance finish.

2.8 END-OF-LINE DEVICES

.1 End-of-line devices to control supervisory current in alarm circuits and signalling circuits, sized to ensure correct supervisory current for each circuit. Open , short or ground fault in any circuit will alter supervisory current in that circuit, producing audible and visible alarm at main control panel and remotely as indicated.

.2 Replace end of line devices to facilitate the renovation.

2.9 GRAPHIC ANNUNCIATOR PANEL

.1 Provide revised active graphic to reflect the renovation in the existing panel located as shown.

2.10 VISUAL ALARM SIGNAL DEVICES

.1 Surface mounted assembly of stroboscopic type suitable for use in electrically supervised circuit and powered from notification appliance circuits.

.2 Appliances: minimum of 110 candela measured as approved by ULC, but not less than effective intensity required by National Building Code of Canada for appliance spacing and location shown.

.3 Protect lamps with thermoplastic lens and labelled "FIRE" in letters at least 12 mm high.

.4 Provide visible appliances within 300 mm of each audible appliance as indicated.

.5 Visible appliances may be part of audio-visual assembly, where more than two appliances are located in same room or corridor.

2.11 CONDUIT

.1 Electrical Metallic Tubing (EMT).

2.12 WIRING

.1 Wire for 120 V circuits: No. 12 AWG minimum solid copper conductor.

.2 Wire for low voltage DC circuits: No. 14 AWG minimum solid copper conductor

.3 Insulation 75 degrees C minimum with nylon jacket.

.4 Colour code wiring.

2.13 ANCILLARY DEVICES

.1 Remote relay unit to initiate fan shutdown.

PART 3 - EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 INSTALLATION

.1 Install systems in accordance with CAN/ULC-S524 and TB OSH Chapter 3-04.

.2 Locate and install detectors and connect to alarm circuit wiring. Do not mount detectors within 1 m of air outlets. Maintain at least 600 mm radius clear space on ceiling, below and around detectors. Locate duct type detectors in straight portions of ducts.

.3 Connect alarm circuits to main control panel.

.4 Locate and install signal bells chimes horns and visual signal devices and connect to signalling circuits.

.5 Connect signalling circuits to main control panel.

.6 Locate and install remote relay units to control fan shut down.

3.3 FIELD QUALITY CONTROL

.1 Site Tests:

.1 Perform tests in accordance with Section 26 05 01 and CAN/ULC-S537.

.2 Fire alarm system:

.1 Test each device and alarm circuit to ensure manual stations, detectors transmit alarm to control panel and actuate alarm.

.2 Check annunciator panels to ensure zones are shown correctly.

.3 Simulate grounds and breaks on alarm and signalling circuits to ensure proper operation of system.

.4 Class A circuits.

.1 Test each conductor on circuits for capability of providing alarm signal on each side of single open-circuit fault condition imposed near midmost point of circuit. Reset control unit after each alarm function and correct imposed fault after completion of each test.

.2 Test each conductor on circuits for capability of providing alarm signal during ground-fault condition imposed near midmost point of circuit. Reset control unit after each alarm function and correct imposed fault after completion of each test.

.5 Class B circuits.

.1 Test each conductor on circuits for capability of providing alarm signal on line side of single open-circuit fault condition imposed at electrically most remote device on circuit. Reset control unit after each alarm function and correct imposed fault after completion of each test.

.2 Test each conductor on circuits for capability of providing alarm signal during ground-fault condition imposed at electrically most remote device on circuit. Reset control unit after each alarm function and correct imposed fault after completion of each test.

.2 Manufacturer's Field Services:

.1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Field Reports as described in PART 1 - SUBMITTALS.

.2 Provide manufacturer's field services consisting of product use recommendations and

3.3 FIELD QUALITY CONTROL (Cont'd)

.2 Manufacturer's Field Services:(Cont'd)
.2 (Cont'd)
periodic site visits for inspection of product installation in accordance with manufacturer's instructions.
.3 Schedule site visits, to review Work, as directed in PART 1 - QUALITY ASSURANCE.

.3 Verification requirements in accordance with Section 01 47 17, include:
.1 Materials and resources.
.2 Storage and collection of recyclables.
.3 Construction waste management.
.4 Resource reuse.
.5 Recycled content.
.6 Local/regional materials.
.7 Low-emitting materials.

3.4 TRAINING

.1 Arrange and pay for on-site lectures and demonstrations by fire alarm equipment manufacturer to train operational personnel in use and maintenance of fire alarm system.

3.5 CLEANING

.1 Proceed in accordance with Section 01 74 11.

.2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END

APPENDICES

WORKER PROFILE SHEET - ANNEX "B"

Worker Name (Print)	
Province of Residence	
Residents of Quebec provide worker No.	
Company Name	
Project Name	
Job Site Address	Environmental Technology Centre, 335 River Road, Ottawa, Ontario, K1A 0H3

Trade Qualifications and Specialized Training

1. Fill in appropriate and applicable information in table below.
2. Provide and attach photocopies of all licenses, certificates, permits, cards and qualifications for trades and specialized training listed in tables below.

Trade Qualifications	License Permit No.	Expiry Date	Apprentice [√]	Labourer [√]
Electrician				
CFAA Registered Fire Alarm Technician				
Plumber				
Gas Fitter Certificate				
Welding				
Refrigeration & Air Conditioning Mechanic				
Ozone Depletion Prevention (ODS) Card/Permit				
Hoisting Engineer				
Sheet Metal Worker				
Steamfitter				
Sprinkler and Fire Protection Installer				
Painter/Decorator				
Floor Covering Installer				
Drywall, Acoustic and Lathing Applicator				
General Carpenter				
Labourer				
Other:				

Specialized Training Course	Training Provided By	Expiry Date
Basic First Aid		
CPR		
WHMIS		
Fall Protection		
Other:		

I, the undersigned, hereby confirm that I have accurately depicted my personal qualifications and training applicable to this job throughout its duration to completion. I further understand and acknowledge that if determined through verification that the information provided is false or inaccurate that I will be expelled from the site.

Worker (signature):_____Date:_____(Day/Month/Year)

Hot Work Permit - ANNEX "C"

Environmental Technology Centre **Building Technologies and Environmental Systems (BTES)** **335 River Road** **Ottawa, Ontario**	
BTES staff member responsible for hot work:	Name(s) of fire watcher(s):
Date and time of scheduled hot work:	Location of hot work:
Contracting firm performing hot work:	
Name(s) of Operator(s) performing hot work:	
License or Certificate No. of Operator(s) performing hot work:	
Description of hot work:	
Special Precautions:	
List Fire Extinguishers (Types/Sizes) available:	

Hot Work Permit - Checklist

Items for Consideration and Review	YES (√)
Has BTES staff member responsible for hot work assessed the potential hazards?	
Has BTES staff member responsible for hot work mitigated the identified hazards?	
Is cutting and welding equipment in state of good repair?	
Have combustible materials been removed at least 10 m from work site or alternately been protected by non-combustible materials?	
Do fire watcher(s) have proper fire protection equipment including portable fire extinguishers and are firewatcher(s) trained in their use and able to sound fire alarm in the event of a fire?	
Will fire watcher(s) be on duty for a minimum of 30 min. after completion of welding or cutting operations?	

Hot Work Permit approved by:

(Print Name) (Signature)

(Position title)

_____/____/_____
(Month/Day/Year)
Building Technologies and Environmental Systems

Hot Work Permit valid:

From:
To:

Time (00:00 hrs) (Month/Day/Year) Time (00:00 hrs) (Month/Day/Year)

Operator to sign section below upon completion of hot work and return original to person authorizing hot work permit.

Hot work completed:
Start:_____ *Completion:_____
Time (00:00 hrs) (Month/Day/Year) Time (00:00 hrs) (Month/day/year)

Completion includes time expended by firewatcher.

Hot Tap Permit - ANNEX "D"

Environmental Technology Centre **Building Technologies and Environmental Systems (BTES)** **335 River Road, Ottawa, Ontario**
BTES staff member responsible for hot tap: _____
Date and time of scheduled hot tap procedure: _____ _____
Justification for hot tap procedure: _____ _____ _____
Contracting firm performing hot tap: _____ _____
Personnel performing hot tap and qualifications: _____ _____
Equipment/system hot tap location: _____ _____
Describe hot tap procedure: _____ _____
Describe Emergency Plan: _____ _____ _____

Hot Tap Permit - Checklist

Items for Consideration and Review	YES (√)
1. A competent BTES person (*name*) shall be present during the hot tapping.	
2. The area where the hot tap connection(s) are to be made has been identified on the equipment and/or piping and locations have been reviewed and confirmed as accurate.	
3. The metal thickness has been verified and any metal imperfections that might prevent a proper seal and weld have been evaluated and approved by a competent person.	
4. All necessary review for flammable vapours, oxygen and hazardous air contaminants has been conducted and mitigating measures are in place to ensure a safe environment.	
5. Potential Health and Safety hazards have been assessed, personal protective equipment (PPE) required for the task is proper and available for contractor(s) and BTES staff.	
6. Fire watch has been established and equipped with a suitably sized and functional dry chemical fire extinguisher.	
7. Signs and barriers have been provided and installed as warranted to protect the safety of personnel.	
8. Procedures have been prepared and are in place to isolate the work area in the event of an emergency.	
9. Emergency plan for first aid and medical assistance in place.	
10. Personnel performing the work are familiar with the hot tapping and welding equipment to be utilized and the hot tapping and welding equipment has been verified to confirm its integrity and operability as per manufacturer's recommendations.	

Hot Tap Permit approved by:

_____

(Print Name) (Signature)

_____

(Position title)

_____/____/_____
(Month/Day/Year)
Building Technologies and Environmental Systems

ANNEX "E"

Environment Canada Environnement Canada

Isolation Procedures

The procedures must be listed in the sequence in which they will be carried out. The sequence must be followed without any deviation. Under "Operation" column indicate the functions to be performed and the specific safety measures required to permit the work to be carried out in a safe manner.

Project No.: **Project Title**: **Date:**
Request for isolation no.:

Purpose of order :

Seq. No. -	Equipment	Tag. No. -	Operation	Initials
1				
2				
3				
4				
5				
6				
7				

Prepared by (*signatures required*)

Name	Time	Date: day	month	year

Checked by

Name	Time	Date: day	month	year

Issued by

Name	Time	Date: day	month	year

Performed by

Name	Time	Date: day	month	year

Planned termination of work

Name	Time	Date: day	month	year

Lock out diagram prepared by

Name	Time	Date: day	month	year

EC (08/2004) *This record must be kept for one year*

Environment Canada Environnement Canada

ANNEX "F"

"**Live" Work Procedure**

When working on a "Live" system is necessary then this "Live" Work Procedure form is to be approved and signed off prior to commencing work. Only the qualified worker using proper PPE should proceed with this approved procedure after all lock out options have been exhausted.

Date of Live Work Request: _____

Date of Planned Live Work: _____

Describe Live system/equipment: _____

_____

Reason for Live Work: _____

_____

Work site - name & location: _____

Live Work Procedure	Name (Print)	Actual Date & Time (24:00 hrs)	Signature	Company
Prepared by:				
Checked by:				
Issued by:				
Performed by:		**Start Date/Time**		
		Finish Date/Time		
Safety Watcher:		**Start Date/Time**		
		Finish Date/Time		

Working Constraints (if any): _____

<u>Live Work Procedure:</u>

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____
8. _____
9. _____
10. _____

The required signed approval of this Live Work Procedure reflects the detailed steps listed above.

BTES Approval of Live Work: _____

Print Name Signature Date & Time

Ref. OHS: 213/91 s. 189, CLC II: 8.4-8.9 EC (11/2004) *this record must be kept for one year – À conserver pendant un an.*

ANNEX "G"

3rd Floor Mechanical Space - Mandatory Safe Working Practices

1. All personnel requiring access to the 3rd floor mechanical space shall, prior to being authorized access for the first time, receive training from Building Technologies and Environmental Systems (BTES) on safe operating procedures in the 3rd floor mechanical space and shall sign this document acknowledging that they have received the required training and that they fully understand and shall follow and respect all procedures and guidelines related to work in the 3rd floor mechanical space as prescribed in this document.

2. BTES shall ensure that sufficient training is provided to each individual requiring access to the 3rd floor mechanical space. Training shall be provided prior to the individual's first time accessing the 3rd floor mechanical space and as frequently thereafter as required by BTES or as requested by the contractor.

3. Only contractors and personnel authorized by BTES shall be granted access to the 3rd floor mechanical space and then only after having received the proper training as determined and provided by BTES.

4. The front reception desk must be notified on a daily or occurrence basis of the requirement of contractors to access the 3rd floor mechanical space. The receptionist or security staff shall arrange for appropriate approval from BTES staff prior to each time the contractor requires access to the 3rd floor mechanical space. The contractor shall not access the 3rd floor mechanical space without having received authorization from BTES.

5. Contractors shall sign in and out at the front reception desk on a daily or occurrence basis.

6. When working in the 3rd floor mechanical space <u>be aware of your location at all times in relation to the closest means of egress.</u>

7. All work determined by BTES to be disruptive to routine building operations shall be performed after normal operations hours (18:00 to 7:00 hours Monday to Friday)

8. BTES shall review and approve all work activities planned for the 3rd floor mechanical space prior to work being initiated. Review and approval shall cover details and safety measures and plans.

9. Should the fire alarm sound, cease work immediately, remain calm and exit building by designated building exits. Close all doors or access hatches in the 3rd floor mechanical space behind you as you exit. Present yourself in the South/West corner of the main parking lot. Locate your BTES contact person (Project Coordinator or Manager) in the main parking lot and indicate if you are aware of any further personnel that may still be in the 3rd floor mechanical space.

10. Be aware of tripping hazards and low hanging and/or sharp objects that may cause bodily injury including, but not limited to, structural steel members, mechanical and electrical piping, wire hangers and wires/cables. Maintain proper balance at all times and keep clear vision in the direction, in which you are traveling or working. <u>Do not run.</u>

11. Always wear and use proper personal protective clothing for each job or task (ie. safety boots, gloves, eye protection, hearing protection etc.)

12. Maintain portable fire extinguishers, type and size suitable for work in question, should the nature of the work undertaken pose a potential fire hazard.

13. Maintain the work area neat and tidy at all times, remove debris daily and do not allow flammable materials to gather or be stored in areas of work.

14. There is "No Smoking" in the 3rd floor mechanical space.

15. Metal ductwork, mechanical and electrical piping shall not be walked on, stepped on or used in place of planking. Exercise care when working around these items.

16. Do not work with power tools where you cannot maintain proper balance.

17. No personnel or contractor shall operate an explosive actuated fastening tool in the 3rd floor mechanical space unless specific prior authorization has been granted by BTES.

18. No personnel or contractors shall perform welding, cutting, or grinding operations in the 3rd floor mechanical space unless specific prior authorization has been granted by BTES. Should welding, cutting, or grinding operations be authorized these minimum safety guidelines shall be observed and followed:

- Obtain a Hot Work Permit from BTES prior to initiating any welding, cutting or grinding activity.
- Wear and use proper protective equipment including helmets, goggles, gloves, safety boots, and welding coats;
- Maintain portable fire extinguishers of the proper type and size within easy reach at all times when welding, cutting or grinding;
- Flammable materials are to be kept a safe distance from all welding, cutting or grinding;
- Fire blankets are to be used;

19. Consideration of how the welding, cutting and grinding operations may affect the building's fire alarm and automatic fire sprinkler systems to be assessed. Appropriate measures shall be taken to avoid false alarms while ensuring adequate protection for the building and it's occupants;

20. Consideration of how smoke, generated by welding, cutting and grinding, may affect the building and its ventilation systems to be assessed. Appropriate measures are to be taken to eliminate concerns with smoke from welding, cutting or grinding.

21. Upon completion the work area shall be thoroughly cleaned including the removal of fallen spray on fire protection (Zonolite).

22. All personnel working in the 3rd floor mechanical space after hours shall use the buddy system unless written authorization, granting exemption from this requirement has been received from BTES prior to accessing the space. Exemption by BTES shall include the requirement for other personal safety measures to replace the buddy system as approved by BTES.

23. It is the responsibility of all parties to report to the reception desk all damages or hazardous conditions observed in the 3rd floor mechanical space.

24. **BTES staff** working in the 3rd floor mechanical space shall not leave the metal catwalks or metal platforms during normal operations hours (7:00 to 18:00 hours Monday to Friday) to perform work except under the following conditions;
    - Work is required on an immediate basis to correct an undesirable situation or it has been deemed by the supervisor or manager that deferral of the work is not in the best interest of ETC, and
    - Work off metal catwalks and/or platforms shall not disrupt (noise, dust, others) routine operations in the space directly below the area where BTES staff will be working nor any adjacent spaces. This shall be verified and confirmed by BTES in discussions with the appropriate personnel occupying spaces directly and indirectly affected by the proposed work.
    - Signs are posted in areas on ground floor directly and indirectly affected by overhead work advising building personnel that work is taking place overhead prior to work being initiated, and
    - Spaces directly below affected work area are vacant, lights are turned off and sign has been posted on door to restrict access, and
    - Protective materials are employed to safeguard the building and building systems.

    **** Only when all of the above criteria are met shall BTES be authorized to work off the metal catwalks or metal platforms.***

    ***** Should all above criteria not be met BTES shall schedule work for after normal operations hours (18:00 to 7:00 hours Monday to Friday).***

    - If, in order to complete urgently required maintenance work, BTES staff are required to work off the metal catwalks or metal platforms during normal operations hours (7:00 to 18:00 hours Monday to Friday) they shall not leave the metal catwalks or metal platforms without prior notification of building staff and personnel affected by the work. Signs and protective measures are to be utilized by BTES in these situations.

25. **Contractors** working in the 3rd floor mechanical space shall under no circumstances leave the metal catwalks or metal platform structures, nor shall they work on the ceiling area nor support themselves on equipment or building systems for any reason during normal operations hours (7:00 to 18:00 hours Monday to Friday). Access to this area to carry out work that necessitates one to leave the metal catwalks or metal platforms shall first be approved by BTES and shall include such measures as the posting of barriers and signs advising affected building occupants, the supply of materials for the protection of the building and building systems and all other requirements as determined by BTES. BTES shall only authorize the contractor to work off the metal catwalks and metal platforms if the contractor consents to implement the safety precautions determined appropriate by BTES. Work that requires one to leave the catwalks or metal platforms must be carried out after normal operations hours (18:00 to 7:00 hours Monday to Friday).

26. Contractors shall at no time hinder the closing of any door or disable the locking mechanism to gain access to the 3rd floor mechanical space.

27. Contractor's staff not observing or respecting any of the policies and guidelines as described in this document shall be escorted from the building and will not be permitted access to ETC for at least 24 hours. Repeat offences by contractor's staff may require the expulsion of the contractor from the building for a period of time to be determined by BTES.

28. **BTES staff and/or contractors** required to work off the metal catwalks, and after having discussed with and received authorization from BTES, shall observe and strictly adhere to the following minimum safe practices as listed below:

- Wood planking, minimum 12 inches wide shall be used to straddle areas not accessible by metal catwalks;
- Wood planking shall be supported by structural members or by the main ceiling hanger supports at a maximum span of 6 feet between support hangers;
- Wood planking shall not be supported in whole or any part by metal ductwork, electrical or mechanical piping systems;
- Hangers, to support the wood planking, must be installed using the trapeze method from the main building structure if necessary;
- Blocking may be used on the main ceiling supports to avoid damage to piping by wood planking;
- Vertical hangers and guy wires used to hold up the drywall ceiling below shall not be used as means of support or balance;
- Vertical hangers and guy wires used to hold up the drywall ceiling below shall not be loosened, altered, cut or removed;

Remember that safety is everyone's responsibility

29. Sign-Off:

Trainee:

_____

Full Name (Print) Company Name (Print)

_____

Signature (Day/Month/Year)

BTES Authorization:

_____

Full Name (Print)

_____

Signature (Day/Month/Year)

Authorization valid from: _____ to _____
(Max. 6 months) (Day/Month/Year) (Day/Month/Year)

ANNEX "H"
Emergency and Fire Evacuation Route

(Constructor's name) shall ensure that all staff and personnel under their responsibility are made aware and fully understand the emergency and fire evacuation route(s) from the area of work as illustrated on the attached diagram(s) (List number of diagrams) entitled (List title of each drawing) and dated (List date of each drawing)

(Constructor's name) shall be responsible to provide a copy of the diagram(s) to each individual under their responsibility upon arrival to the work site and shall further be responsible to advise and train the individuals on how and when to egress the work area following the evacuation routes as per training provided by BTES and respecting the ETC Fire Safety Plan.

(Constructor's name) by signing the form below acknowledges having received emergency and fire evacuation route awareness training from Environment Canada including the evacuation routes away from the work areas. Further by signing the form below, (Constructor's name) acknowledge their responsibility to provide emergency and fire evacuation route awareness training to all personnel under their responsibility. (Constructor's name) also acknowledges and understands that disregard or lack of compliance to Emergency Evacuation training shall lead to disciplinary action including, but not limited to, expulsion from the site of the offenders.

I, (BTES Project Manager) have provided emergency and fire evacuation route awareness training to (Insert individual's name) designated site superintendent for (Constructor's name), respecting the ETC Fire Safety Plan.

(Signature) Date
(Project Manager)
Building Technologies and
Environmental Systems

I, (Insert individual's name) of (Constructor's name) acknowledge having received emergency and fire evacuation awareness training. I further consent to undertake and provide emergency and fire evacuation awareness training for all personnel and staff under my responsibility.

(Signature) Date
(Insert individual's name)
(Constructor's name)

CANADA CENTRE FOR INLAND WATERS (CCIW)
BUILDING AND PROPERTY TECHNICAL SERVICES (BPTS)
LOCK OUT TAG OUT (LOTO) reference

For complete Zero Energy State Procedures, Lock Out Tag Out, refer to Building and Property Technical Services (BPTS) Operating Manual located in L122.

1.1.1. The purpose of this document is to set out procedures to be followed by BPTS personnel, and contractors, of the CCIW facility, relating to electrical, mechanical, and pressure system shut-off, de-energization, lockout and tagging, prior to performing work on such systems.

2.4 Energy source "may include but is not limited to electrical, electromagnetic, thermal, mechanical, pneumatic, hydraulic or gravitational potential energy."

2.5. "…lockout is the use of a lock or locks to render machinery or equipment inoperable or to isolate an energy source in accordance with a written procedure. It includes the act of affixing a key-opened pad lock to a de-energized circuit breaker, power switch, fuse, or panel cover, so as to make it impossible for electrical power to be turned on …"

2.6. "…**person with primary responsibility is the CCIW Manager of BPTS or a Facility Systems Technologist, who has been assigned primary responsibility for supervising the work**."

3.1.2. "Each trade that will work on the equipment is in turn responsible to ensure that their lock is placed on the same hasp. The person with primary responsibility shall be the last to remove their lock and ensure that all other affected employees are aware that the equipment will be re-energized. …"

4.2.3. Before any work is done on or near electrical equipment the power supply must be isolated and the employee, worker, or contractor fully informed by the person with primary responsibility with respect to the safe co-ordination of their work.

4.2.4. Isolated equipment shall be considered to be electrical equipment for which the power supply has been
(1) disconnected and/or de-energized;
(2) locked out of service, and
(3) tagged
(4) tested to confirm isolation
The power supply must remain isolated (disconnected, locked out and tagged) at all times while work is being done.

4.2.5. Testing to confirm isolation shall include the following
(a) test of all normal starting function (push start buttons, test switches, etc.)
(b) "…visual inspection of all lockout locations by the person with primary responsibility to confirm:
(i) disconnecting components of control devices and switch gear have safely separated;
(ii) isolating devices have been correctly applied;
(iii) locks have been applied by all involved workers at all lockout locations; and
(iv) tags have been applied by all involved workers at all lockout locations."

4.2.6. "…The Identification Tag shall
(a) be made of non-conducting material
(b) be secured to the lock, or similarly conspicuous location, when in use to prevent inadvertent removal
(c) shall contain the words "DO NOT OPERATE – DEFENSE D'ACTIONNER" or equivalent symbol;
(d) shall state the reason for the disconnect and lockout
(e) indicate the date and hour of disconnect, lockout and isolation test.
(f) shall state the worker's name"

5.1. De-energizing and lockout are likely to be required if any of the following conditions prevail:
- work involves actual or potential contact with electrical wires
- work involves actual or potential contact with machine parts that are, or can, move, and thereby cause injury
- work could initiate the operation of a machine
- work could cause the release or discharge of pressurized air or liquid
- work requires placement of body or body part underneath an object that could fall down under gravity

9.3.1. **Contact the Person with Primary Responsibility before beginning any work requiring LOTO**.

Contractor name/company: _____
CCIW authority: _____
Date: _____

October 31, 2013
MTE File No.: 33689-300

Mrs. Carolyn Smith
Reich+Petch
1867 Yonge Street, Suite 1100
Toronto, ON M4S 1Y5

Dear Mrs. Smith:

Re: CCIW Library HDMS
867 Lakeshore Road, Burlington, ON

Introduction

At your request, we structurally reviewed the existing second floor concrete structure for your proposed (new) layout of the High Density Mobile System (HDMS). The primary objective of this review was to investigate if the existing structure could accommodate the proposed HDMS layout and loading.

Background

Further to our report issued to Environment Canada on March 28, 2012, you have requested that we further investigate the existing second floor structure for your proposed layout of the HDMS shown on sketch SK-1.1.1 dated June 6, 2013 (see attached).

We summarize our understanding as follows:

a. The existing concrete structure is structurally sound;
b. The proposed filing units are to be supplied by Montel with the same specifications as included in our report issued on March 28, 2012;
c. The total surface load is 175 psf for the self weight of the 5 shelves filing units and contents;
d. The fixed filing units rest uniformly (surface load) on the existing concrete slab. The movable filing units rest on rails (line load) spaced at 72" o.c. maximum. The proposed filing units are a mix of fixed and movable units. Each unit is composed of 5 shelves high. See attached architectural sketch SK-1.1.1 for further information.

MTE Consultants Inc.
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Phone: 905-639-2552
Fax: 905-639-7727
www.mte85.com

MTE
More Than Engineering
25 YEARS 1985-2010

Conclusion and Recommendation

Based on our structural load review, it is our opinion that the existing second floor concrete structure would be overstressed (could not support safely) when exposed to your proposed layout of the HDMS shown on sketch SK-1.1.1 dated June 06, 2013.

As a result, we would recommend the layout of the HDMS to be as marked-up by MTE on July 3, 2013 (see attached marked-up sketch) as this could be safely resisted by the existing concrete structure.

Yours truly,

MTE CONSULTANTS INC.

Adolfo Barreirinha, P.Eng.
Project Manager

LICENSED PROFESSIONAL ENGINEER
A. BARREIRINHA
100012613
Oct 31/13
PROVINCE OF ONTARIO

Limitations

This letter has been prepared by MTE Consultants Inc. (MTE) at the request of Mrs. Carolyn Smith (Reich+Petch). The material in it reflects the best judgment of MTE in light of the information available at the time of preparation. Any use which a third party makes of this report, or any reliance on or decisions made based on it, are the responsibility of such third parties. MTE accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this letter.

This assessment does not wholly eliminate uncertainty regarding the potential for existing or future costs, hazards or losses in connection with a property. No physical or destructive testing and no design calculations have been performed unless specifically recorded. Conditions existing but not recorded were not apparent given the level of study undertaken. We can perform further investigation on items of concern if so required. Only the specific information identified has been reviewed. The consultant is not obligated to identify mistakes or insufficiencies in the information obtained from the various sources or to verify the accuracy of the information. The Consultant may use such specific information obtained in performing its services and is entitled to rely upon the accuracy and completeness thereof.

Responsibility for detection of or advice about pollutants, contaminants or hazardous materials is not included in our mandate. In the event the Consultant or any other party encounters any hazardous or toxic materials, or should it become known to the Consultant that such materials may be present on or about the jobsite or any adjacent areas that may affect the performance of the Consultant's services, the Consultant may, at its option and without liability for consequential or any other damages, suspend performance of its services under this Agreement until the Client retains appropriates consultants to identify and abate or remove the hazardous or toxic materials and warrants that the jobsite is in full compliance with all applicable laws and regulations.

Any time frame given for undertaking work represents an educated guess based on apparent conditions existing at the time of our letter. Failure of the item, or the optimum repair/replacement process, may vary from our estimate. We accept no responsibility for any decisions made or actions taken as a result of this letter unless we are specifically advised of and participate in such action, in which case our responsibility will be as agreed to at that time. Any user of this letter specifically denies any right to claims against the Consultant, Sub-Consultants, their Officers, Agents and Employees in excess of the fee paid for professional services.

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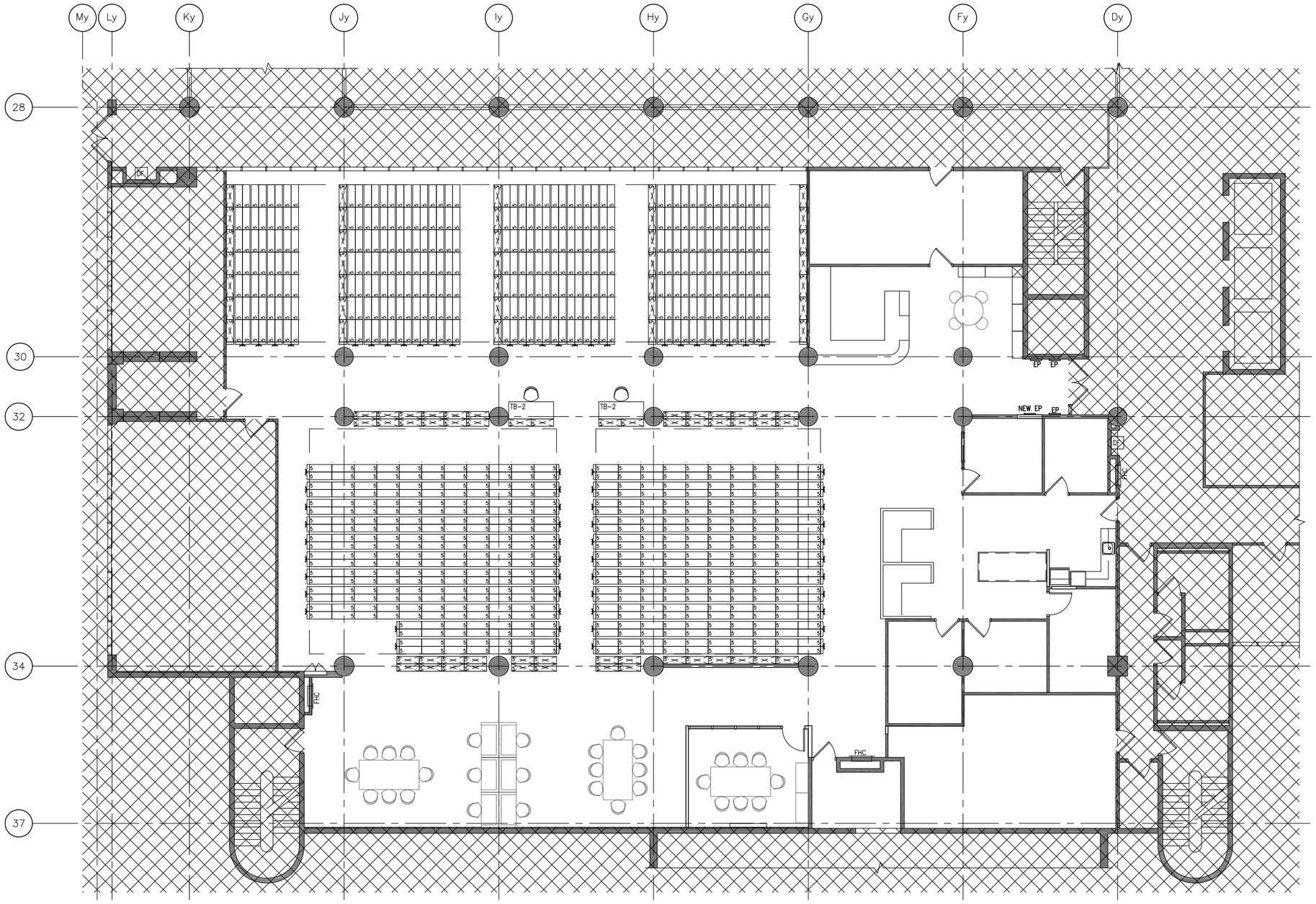

Reich + Petch ARCHITECTS

1867 YONGE ST, STE 1100, TORONTO ON CANADA M4S 1Y5
T 416 480 2020 F 416 480 1881

CANADIAN CENTRE FOR INLAND WATERWAYS - LIBRARY RENOVATION

PROJECT No. 1210

DRAWING TITLE: PROPOSED NEW FLOOR PLAN

DRAWING NUMBER SK - 1.1.1

DATE: JUNE 06, 2013 | SCALE: 1 : 175 | REF.:

REV. NUMBER ( )

PLOT DATE: 06 Jun 2013

(11x17 Inches)

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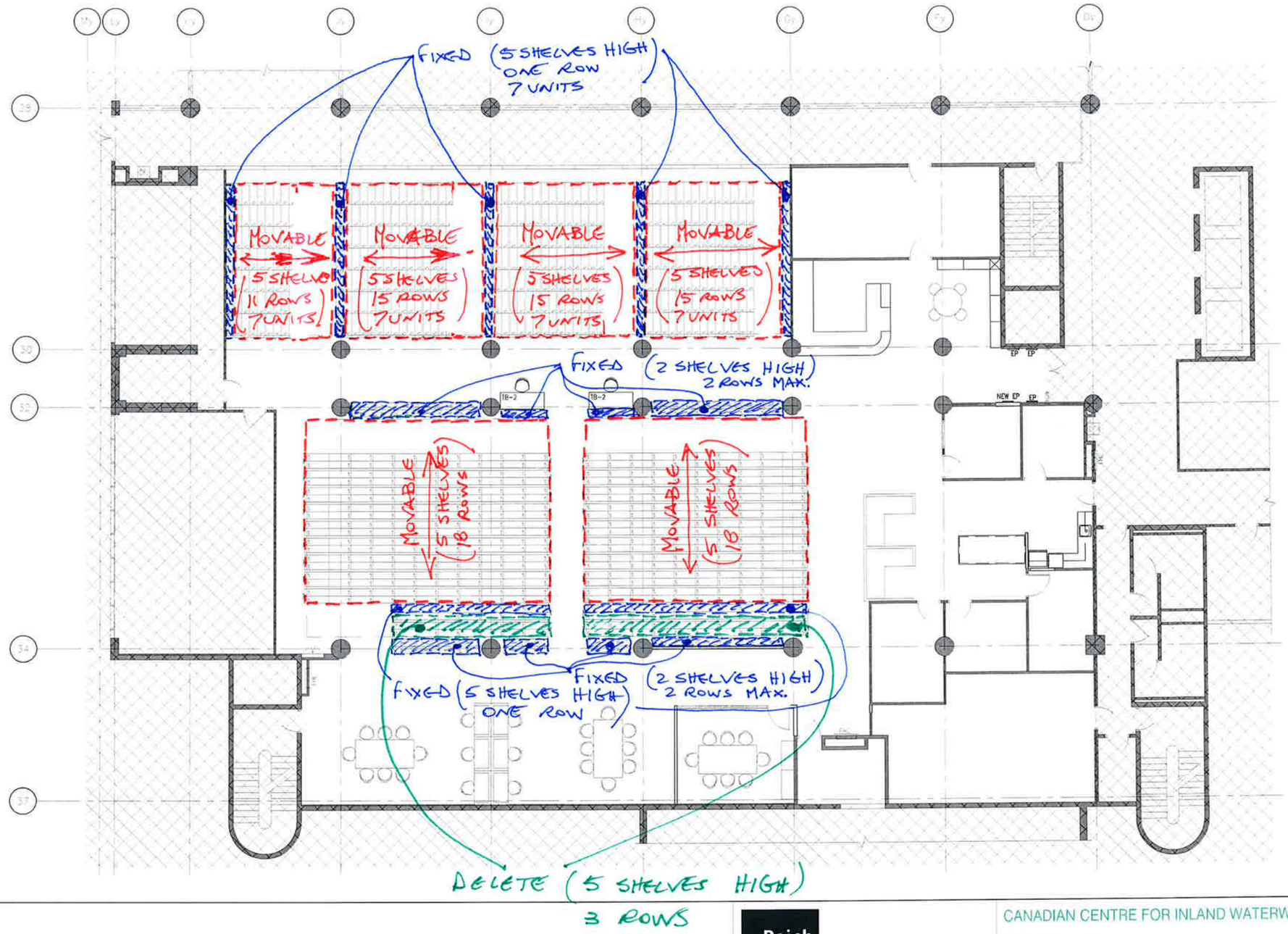

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CANADIAN CENTRE FOR INLAND WATERWAYS - LIBRARY RENOVATION

PROJECT No. 1210

DRAWING TITLE: PROPOSED NEW FLOOR PLAN

DRAWING NUMBER SK - 1.1.1

DATE: JUNE 06, 2013 SCALE: 1 : 175 REF.: REV. NUMBER ( )

PLOT DATE: 06 Jun 2013

(11x17 inches)

Public Works and Government Services Canada

Travaux publics et Services gouvernementaux Canada

Canada Centre for Inland Waters
867 Lakeshore Road
PWGSC Engineering Asset Properties

PWGSC Project R.061475.002

131-25127-00

DESIGNATED SUBSTANCES AND HAZARDOUS MATERIALS SURVEY REPORT

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PWGSC Project R.061475.002
GENIVAR Project 131-25127-00

December 17, 2013

Ms. Maegan Harrison
Senior Environmental Specialist
Public Works & Government Services Canada
4900 Yonge Street, 11th Floor
Toronto, Ontario M2N 6A6

Re: Project-Specific Designated Substances and Hazardous Materials Survey (PS-DSHMS) Canada Centre for Inland Waters, 867 Lakeshore Road, Burlington, ON

Dear Ms. Harrison:

This report documents relevant background information, methodologies utilized, work undertaken and the findings of the Designated Substances and Hazardous Materials Survey (DSHMS) of the library and adjacent areas of the Canada Centre for Inland Waters located at 867 Lakeshore Road in Burlington, ON, as conducted by GENIVAR on December 5th, 2013.

Please do not hesitate to contact the undersigned if you have any questions.

Yours truly,

GENIVAR Inc.

Stephen Heikkila, E.I.T
Environmental Scientist

Cesare Paoletti, P. Eng.
Project Manager, Environment

[Project-Specific Designated Substance and Hazardous Materials Survey Report for Canada Centre for Inland Waters, Burlington, ON]

Executive Summary

GENIVAR Inc. (GENIVAR) was retained by Public Works and Government Services Canada (PWGSC) on behalf of Environment Canada (EC) to conduct a Project-Specific Designated Substances and Hazardous Materials Survey (PS-DSHMS) in support of planned upgrades in the library and adjacent areas ("the subject areas") of the Canada Centre for Inland Waters (CCIW) Administration Building ("subject building") located at 867 Lakeshore Road, in Burlington, Ontario.

The objectives of this survey were as follows:

1) To identify designated substances and/or hazardous materials that may be present in the subject areas;

2) To prepare a report documenting the identities, usages locations and quantities of any designated substances and hazardous materials identified within the subject areas and;

3) To provide PWGSC and EC with recommendations for the management of these materials in support of planned upgrades.

The primary findings of this survey are summarized below:

Designated Substance/ Hazardous Material	Survey Findings
Asbestos	The following asbestos-containing materials were identified within the subject areas: • *Vinyl Floor Tile – 12"x12" beige with dark streaks* • *Mechanical Insulation (pipe elbows, flanges, ductwork)* • *Fire Doors (Presumed)*
Lead	The following lead-containing paints were identified within the subject areas: • *Beige Door Paint* • *Purple Wall Paint* • *Black Wall Paint* • *Cream Wall Paint* • *White Wall Paint* • *Light Purple Door Paint* • *Orange Door Paint* • *Black Bookshelf Paint* • *Purple Bookshelf Paint* • *Green Mechanical Room Paint*
Silica	Building/construction materials known to contain silica such as glass, concrete, masonry, stone and mortar were observed within the subject areas.
Mercury	Mercury vapour is presumed to be present within fluorescent light tubes identified within the subject areas (approximately 150 light tubes).
PCBs	Fluorescent lights were observed within the subject areas. The majority of the light fixtures within the subject areas were inspected to evaluate the potential for PCBs in the lamp ballasts. Those inspected were found to be free of PCBs. However, based on the building's construction date/era, it is possible that PCB ballasts may still be present in some of the light fixtures which were not inspected, especially those in hard to reach areas.
ODS	Refrigerants within air conditioning units and refrigerators observed within the subject areas were found to be non-ozone-depleting substances (non-ODS).

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1. Introduction

1.1 Site Description

GENIVAR Inc. (GENIVAR) was retained by Public Works and Government Services Canada (PWGSC) on behalf of Environment Canada (EC) to conduct a Project-Specific Designated Substances and Hazardous Materials Survey (PS-DSHMS) in support of planned upgrades in the library and adjacent areas ("subject areas") of the Canada Centre for Inland Waters (CCIW) Administration Building ("subject building") located at 867 Lakeshore Road, in Burlington, Ontario. The subject building was reportedly constructed in the late 1960s.

EC is planning to combine all libraries across the province at the CCIW library. Since the current 3,400 square foot library cannot provide adequate housing for all the anticipated content, renovations are required, including the installation of High Density Mobile Shelving (HDMS). In addition, the renovations will include mechanical and electrical upgrades to bring the space up to code, and a new sprinkler system installation in the library and in the ground floor office areas below the library. The piping and HVAC systems in the library will be completely replaced as well.

The DSHMS conducted by GENIVAR on December 5, 2013.

1.2 Survey Objectives

The DSHMS was conducted to identify the designated substances and hazardous materials, including (but not limited to) asbestos, lead, mercury, silica, polychlorinated biphenyls (PCBs) and ozone-depleting substances (ODS) present in the subject areas. GENIVAR inspected the all the accessible areas and building spaces in the subject areas and when deemed necessary, representative samples of suspect asbestos-containing materials (ACM) and lead-containing paint were collected in accordance with applicable regulations.

This report has been prepared to document the identities, usages locations and quantities of designated substances and hazardous materials identified within the subject areas, and to provide PWGSC and CCIW with recommendations for the management of these materials in support of the planned upgrades.

1.3 Scope of Work

The areas and components inspected as part of this project were in accordance with those specified in the Statement of Work (PWGSC Project R.061475.002) for the project issued October 31, 2013.

A thorough intrusive, but not destructive, survey was undertaken of the following:

- All accessible areas and building spaces within the specified areas;
- Building construction materials within the specified areas;
- Components, fixtures, and fixed equipment/furniture within the specified areas;

The DSHMS consisted mainly of the following tasks:

- A review of building plans and available environmental reports;
- A systematic (room-by-room) survey of the subject areas, and also included a visual inspection of the first floor office ceiling space, to determine whether or designated substances may be disturbed by sprinkler system upgrades;
- Sampling of suspect materials (where necessary);
- Submission of samples to an accredited independent laboratory for analysis;

- Preparation of this report detailing observations from the site visit as well as providing recommendations for management, repair, or removal of these materials as applicable.

1.4 Regulatory Context

Section 30 of the *Occupational Health and Safety Act* (the Act) stipulates that prior to the commencement of a project a list shall be prepared of all designated substances that are present at the project site (i.e. a designated substances survey). In accordance with the Act, the locations of designated substances must be identified in writing to all prospective constructors, contractors and sub-contractors who may work, disturb or come into contact with this type of material, at the same time as, or prior to, project tendering.

The term "designated substance" refers to the eleven chemical or physical agents specifically identified within the Act. Each of these substances is governed by its own respective regulation that defines the minimum health and safety requirements for assuring safe worker-substance interaction as well as the obligations of employers and workers in workplaces containing said substances. These regulations further stipulate the maximum concentrations of the respective substance to which a worker may be exposed, according to short-term exposure values and time-weighted average exposure values. Table 1 lists the eleven chemical/physical agents identified in the act as well as their respective regulations and corresponding amendments.

Table 1 Ontario Occupational Health & Safety Regulations for Designated Substances

Designated Substance	Applicable Regulation	Most Recent Amendment
Acrylonitrile	O. Reg. 490/09	O. Reg. 148/12
Arsenic	O. Reg. 490/09	O. Reg. 148/12
Asbestos	O. Reg. 490/09	O. Reg. 148/12
Asbestos *(on Construction Projects and in Buildings and Repair Operations)*	O. Reg. 278/05	O. Reg. 479/10
Benzene	O. Reg. 490/09	O. Reg. 148/12
Coke Oven Emissions	O. Reg. 490/09	O. Reg. 148/12
Ethylene Oxide	O. Reg. 490/09	O. Reg. 148/12
Isocyanates	O. Reg. 490/09	O. Reg. 148/12
Lead	O. Reg. 490/09	O. Reg. 148/12
Mercury	O. Reg. 490/09	O. Reg. 148/12
Silica	O. Reg. 490/09	O. Reg. 148/12
Vinyl Chloride	O. Reg. 490/09	O. Reg. 148/12

1.5 Additional Regulatory Requirements for Asbestos

Among the designated substances, asbestos is unique in that it is governed by two regulations under the Act - one for the general mining and processing operations of asbestos and one for asbestos on construction projects and in buildings and repair operations.

Ontario Regulation 278/05, made under the Act, entitled "Designated Substance – Asbestos on Construction Projects and in Buildings and Repair Operations" came into effect on November 1st, 2005, with some sections contained therein becoming effective on November 1st, 2007. This regulation revoked and replaced the previous asbestos regulation, *O.Reg. 838/90*.

O.Reg. 278/05 introduced significant changes to how asbestos management is regulated in Ontario. Many of the regulatory changes adopted by O. Reg. 278/05 were already in wide-use in industry as part of best management practices. Noteworthy regulatory changes include modifications to asbestos survey requirements, the management of asbestos on-site, abatement operations and procedures (i.e. Type 1, 2 and 3), the use of personal protective equipment (PPE) and air monitoring requirements.

1.6 Additional Regulatory Requirements for Lead

In April 2005, the federal *Surface Coating Materials Regulation (SOR/2005-109)* limited the allowable concentration of total lead present in a surface coating material (with some exceptions) to 600 mg/kg (600 ppm).

In December 2010, the Federal Government lowered the total lead limit in surface coating materials from 600 mg/kg to 90 mg/kg under subsections 4(1) and 5(1) and section 8 of the *Surface Coatings Materials Regulations (SOR/2005-109)*. The lowering of this limit aligns Canada with the United States in respect of total lead levels in surface coating materials and certain products with surface coating materials applied to them.

Therefore, using this revised threshold limit, those surface coating materials with lead concentrations that exceed 90 ppm (0.009% by weight) are considered to be lead-based for the purposes of this assignment.

1.7 Polychlorinated Biphenyls (PCB)

Polychlorinated Biphenyls (PCBs) are industrial chemicals which were synthesized and commercialized in North America starting in 1929. PCB oils were used in the manufacturing of fluorescent light ballasts, electrical equipment, heat exchangers, hydraulic systems, and several other specialized applications up to the late 1970s. They were never manufactured in Canada but were nevertheless widely used.

The CEPA regulation regarding PCBs (*SOR/2008-273*) should be referred to regarding the use, storage, labelling, reporting and eventual disposal of PCB-containing materials.

1.8 Ozone-Depleting Substances (ODS)

Certain chemicals such as, chlorofluorocarbons (CFC), hydro chlorofluorocarbons (HCFC) and halons are recognized as ozone-depleting substances (ODS) because they breakdown in the stratosphere and release chlorine or bromine, which destroy the stratospheric ozone layer. The most common uses of ODS are as refrigerants in commercial, home and vehicle air conditioners and refrigerators, foam blowing agents, solvents, aerosol spray propellants, fire extinguishing agents and chemical reactants.

The Federal Halocarbon Regulations 2003, Section 3 states that "No person shall release, or allow or to cause the release of, a halocarbon that is contained in (a) a refrigeration system or an air-conditioning system, or any associated container or device, unless the release results from a purge system that emits less than 0.1 kg of halocarbons per kilogram of air purged to the environment." The disposal of halocarbon is also covered under the Federal Halocarbon Regulations 2003, Section 8, which states "Before dismantling, decommissioning or destroying any system, a person shall recover all halocarbons contained in the system into a container designed and manufactured to be refilled and to contain that specific type of halocarbon."

In January 2011, Ontario's Ministry of the Environment consolidated five ODS regulations into one single regulation as part of its efforts to modernize regulations by updating and removing obsolete regulatory requirements (*O.Reg. 463/10*).

O.Reg. 463/10 made under Ontario's Environmental Protection Act governs the discharge, making, use, sale, transfer, display, transport, store and disposal of ozone-depleting substances and other halocarbons.

In addition, Sections 30 to 42 of the General Waste Management regulation (*O.Reg. 347/90*) sets out requirements for the disposal of mobile and stationary refrigerant waste, and section 5 of the Classification and Exemption of Spills and Reporting of Discharges regulation (*O.Reg. 675/98)* provides exemptions for a spill of refrigerant of less than 100 kilograms from the reporting provisions of Part X of the Environmental Protection Act.

1.9 Additional Regulatory Requirements for Waste Management

The disposal of designated substances is regulated under the Ontario *Environmental Protection Act* (the EPA), specifically *O. Reg. 347 – General – Waste Management* (as amended). The regulation details the minimum requirements for the appropriate transport and disposal of wastes.

In addition to the EPA waste management requirements, the *Canada Wide Standards on Fluorescent Lamps Containing Mercury* requires that quantities of fluorescent light tubes destined for waste in excess of 25 tubes are to be considered hazardous waste and thus must be disposed of in a manner that is compliant with *O.Reg. 347*.

The *Transportation of Dangerous Goods ("TDG") Act, 1992,* as amended, defines handling as "loading, unloading, packing or unpacking dangerous goods in a means of containment for the purposes of, in the course of or following transportation and includes storing them in the course of transportation." TDG requirements may also apply, and need to be considered when handling dangerous goods including designated substances, for disposal purposes.

2. Methodology

2.1 General DSHMS Survey Methodology

GENIVAR's DSHMS sought to identify those substances defined as designated substances under the *Ontario Occupational Health and Safety Act* including: asbestos (friable and non-friable), lead, mercury, silica, polychlorinated biphenyls (PCB), ozone-depleting substances (ODS), benzene, acrylonitrile, arsenic, coke oven emissions, ethylene oxide, isocyanates, and vinyl chloride.

The surveyor performed a systematic survey of the subject areas for the purposes of identifying observable designated substances and hazardous materials and documenting observations made about their locations, estimated quantities and respective conditions. These observations form the basis of management considerations and remedial actions provided in Section 4 of this report.

Bulk samples were collected from suspect building materials (materials known as having the potential to be asbestos-containing) for analysis of their asbestos content. Paint chip samples were also collected from paint applications for analysis of their lead content. Survey procedures specific to asbestos-containing materials and lead are documented in Sections 2.2 and 2.3 of this report, respectively.

Prior to undertaking the DSHMS, GENIVAR conducted a review of any existing designated substances and hazardous materials survey reports of the subject areas/building, which were made available by the PWGSC Project Manager. Based on GENIVAR's review of Pinchin Environmental asbestos survey report entitled "Asbestos Assessment Report, Canada Centre for Inland Waters, 867 Lakeshore Rd., Burlington, ON" and dated July 12, 2013, a number of materials throughout the subject building were previously identified or presumed to be asbestos-containing including: texture finish, pipe insulation, mechanical insulation, duct insulation, plaster, drywall joint compound, asbestos cement ("Transite"), vinyl sheet flooring, vinyl floor tile, and "Bakelite" laboratory countertops.

So as not to duplicate efforts, where possible, materials previously sampled in the subject areas and which were clearly confirmed to be ACM in previous reports, were not re-sampled during this current investigation, and were noted to be previously confirmed ACM.

2.2 Asbestos Survey Methodology

The surveyor inspected the subject areas for the presence of friable and non-friable asbestos-containing materials (ACM). Examples of ACM commonly found in buildings include the following (the materials listed below were not necessarily observed within the subject areas):

- Sprayed insulation;
- Acoustic/texture plaster;
- Drywall joint compound
- Mechanical insulation;
- Asbestos cement;
- Piping;
- Acoustic ceiling tiles;
- Vinyl floor tiles and vinyl sheet flooring; and,
- Plaster.

Bulk samples were collected from suspect materials and analyzed to confirm the presence/absence of asbestos. The collection of bulk material samples was performed according to the procedures documented in the Ontario Ministry of Labour's (MOL) publication *Designated Substances in the Workplace: A Guide to the Asbestos Regulation for Construction Projects, Buildings and Repair Operations.*

O.Reg. 278/05 stipulates the minimum number of samples that must have asbestos concentrations less than 0.5% in order for an area of homogenous material to be not considered asbestos-containing. A homogeneous sampling area is defined by the USEPA as containing material that is uniform in texture and appearance, was installed at one time and is unlikely to consist of more than one type or formulation of material. The *O.Reg. 278/05* sampling requirements are summarized in greater detail in Table 2, below.

In addition, the minimum number of bulk samples collected followed *PWGSC's Departmental Policy 057 – Asbestos Management*.

Table 2 Minimum Number of Bulk Samples to be Collected Under O. Reg. 278/05 According to Material Area, Application and Friability

Type of Material	Size of Homogenous Material	Minimum Number of Bulk Samples
Surfacing material, including without limitation material that is applied to surfaces by spraying, by trowelling or otherwise, such as acoustical plaster on ceilings, fireproofing materials on structural members and plaster	Less than 90 m^2	3
	90m^2 or more, but less than 450m^2	5
	450m^2 or more	7
Thermal insulation, except as described below	Any size	3
Thermal insulation patch	Less than 2m or 0.5m^2	1

Table 2 Minimum Number of Bulk Samples to be Collected Under O. Reg. 278/05 According to Material Area, Application and Friability

Type of Material	Size of Homogenous Material	Minimum Number of Bulk Samples
Other material	Any size	3

Samples were collected from discrete locations with every attempt to minimize damage. All sample locations were left in a safe condition. The following procedures for collection of samples were followed:

- The surface of the material was wetted with amended water using a spray bottle. In situations where the material could not be wetted, a plastic bag or other containment device was placed around the sampling device.
- A sample was obtained by one of two methods;
  1) A sampling device was slowly pushed into the material with a twisting motion until the entire thickness was penetrated, followed by extraction of the sampling device, or;
  2) A knife was cleaned and then used to excise a piece of the material.
- Each sample was placed in a clear bag with a tight closure, labelled appropriately and placed in a second, similar bag.
- Debris was cleaned with wet paper towels and discarded into a plastic bag.
- Damage to the material sampled was repaired with duct tape and/or filler material as needed.

Vinyl floor tiles were analyzed using transmission electron microscopy (TEM) following the NIOSH 7402 method of analysis.

Bulk samples from suspect building/construction materials were collected and submitted to an independent and accredited laboratory, for analysis using Polarized Light Microscopy (PLM) following the U.S. EPA/600/R-93/116 Method. Laboratories used for bulk sample analysis are certified under the National Voluntary Laboratory Accreditation Program (NVLAP) to perform asbestos analysis of bulk samples.

2.3 Lead Survey Methodology

Bulk paint samples (paint chip) from distinct colours observed within the facility were collected during the survey and submitted for analysis of lead content. Samples were collected with the aid of a thin-bladed knife, which was cleaned prior to each sampling event. The site surveyor selected sample locations where it appeared that the paint application was most representative of all areas on which it was applied. Each paint chip sample was placed in a clear bag with a tight closure, labelled appropriately and placed in a second, similar bag. A chain of custody form was completed for all samples collected on-site and accompanied the samples during shipment to an independent laboratory for analysis.

It should be noted that lead concentrations are assumed to be consistent for each respective paint colour observed (e.g. all white-coloured paint is assumed to have the same lead concentration wherever it is observed, regardless of the surface or underlying material it's applied to, in the subject areas).

To determine their lead content, samples were submitted to an independent and accredited laboratory and analyzed using Atomic Absorption Spectroscopy (AAS).

A summary of the bulk paint samples collected, including a sample description, sampling location, and laboratory test results is provided in the applicable section, below. Samples locations are identified on the Figures, provided in **Appendix A** of this report.

3. Observations and Results

The designated substances and hazardous materials identified by this survey are detailed below. Figures of the surveyed areas including the locations of any identified asbestos-containing materials, designated substances and hazardous materials can be found in **Appendix A**. Laboratory Certificates of Analysis are provided in **Appendix B** of this report. Relevant site photographs taken during the survey are presented in **Appendix C** of this report.

3.1 Asbestos

3.1.1 Vinyl Floor Tile

Two styles of vinyl floor tile were observed within the subject areas. Representative samples of each style were collected and submitted to an independent and accredited laboratory for analysis of asbestos content. One of the styles (12”x12” off-white with dark streaks) was found to contain up to *5% Chrysotile* asbestos, whereas the other was found not to contain asbestos. The vinyl floor tiles were observed to be in good condition at the time of the survey.

3.1.2 Mechanical Insulation

Mechanical insulation on pipe fittings including elbows, flanges and valves and tees, were found to contain *30% Chrysotile* asbestos. At least 12 pipe fittings (7 elbows and 5 flanges) in the 3rd floor mechanical room will be affected by the upcoming renovation project in the subject area. In addition, *Pinchin’s 2013 “Asbestos Assessment” Report* identified duct insulation in the mechanical room as asbestos-containing. Therefore, mechanical pipe fitting and ductwork insulation which appears similar (in appearance, colour and texture) throughout the mechanical room and subject areas, should be presumed to contain asbestos unless proven otherwise.

3.2 Lead Paint

Bulk paint samples (paint chips) were collected from each distinct colour of paint observed in the subject areas. A total of eleven (11) paint chip samples were collected. The paint chip samples were submitted to an independent and accredited laboratory for analysis of lead content.

The lead concentrations of ten (10) of the analyzed paints were found to exceed the threshold limit of 0.009% (lead by weight) established for this assignment. Therefore, these paint applications are considered to be “lead-containing” under the federal *Hazardous Products Act* (*Surface Coating Materials Regulation*).

3.3 Silica

Materials known to contain silica such as concrete and mortar were observed in the subject areas. These types of materials are prevalent throughout the building structure and require consideration in advance of their disturbance.

3.4 Mercury

Mercury vapour is assumed to be present within fluorescent light tubes observed within the subject areas (approximately 150 light tubes). Also, at least two (2) liquid mercury-containing thermometers were observed in the 3rd floor mechanical room, and may be disturbed by the planned mechanical upgrades in the subject areas.

3.5 PCB

Fluorescent lights were observed within the subject areas. GENIVAR understood that only the lights in the library area will be affected by the planned upgrades. Therefore, the majority of lamp ballasts within this area only were individually inspected during the survey, all of which were found to be “PCB-free”.

However, based on the building’s construction date/era, it is possible that PCB ballasts may still be present in the subject areas in light fixtures which were not inspected, especially those in “hard-to-reach” or inaccessible areas.

3.6 Other Designated Substances and Hazardous Materials

The survey also included an identification of the following designated substances and hazardous materials, none of which were observed to be present:

- Mould
- Ozone-Depleting Substances
- Acrylonitrile
- Arsenic
- Benzene
- Coke Oven Emissions
- Ethylene Oxides
- Isocyanates
- Vinyl Chloride Monomer
- Urea Formaldehyde Foam Insulation (UFFI)

It should be noted that although these substances were not physically observed within the framework of this assessment (a non-destructive investigation), there is potential for these materials to still exist, concealed behind wallboards, ceilings and other inaccessible building spaces.

4. Conclusions and Recommendations

The following sections summarize the DSHMS findings and associated recommendations, with additional details presented in other relevant report sections.

4.1 Asbestos-Containing Materials

The following table summarizes the asbestos-containing materials identified by the survey along with recommended remedial actions for each material.

Table 3 Summary of Asbestos-Containing Materials

Location	Material / Quantity	Assessment	Action[1]

Location	Material / Quantity	Assessment	Action[1]
2nd Floor - Library Kitchen and Office Area	Vinyl Floor Tile 12"x12" beige with dark streaks Approximately 40 m^2	- ***Sample ID***: CCIW - 10A to C - ***Concentration***: *5.0% Chrysotile* - ***Material:*** Non-Friable - ***Accessibility***: A *(Areas of the building within reach, from floor level, of all building users. Activities of the building users may result in disturbance of ACM not normally within reach from floor level)* - ***Condition***: Good	Prior to demolition/construction remove this material following; ***Type 1*** procedures – if the material is *wetted* and the work is done using *non-powered hand tools*[2] .
3rd Floor - Mechanical Room	Mechanical insulation on pipe elbows, flanges, valves, etc. Approximately 12 fittings in area to be disturbed by upgrades. Also, mechanical insulation on ductwork was previously determined to be ACM.	- ***Sample ID***: CCIW - 12A to C - ***Concentration***: *30% Chrysotile* - ***Material:*** Friable - ***Accessibility***: B *(Frequently entered maintenance areas within reach of staff, without the need for a ladder)* - ***Condition***: Good	Prior to demolition/construction remove this material following; ***Type 2 (glovebag)*** OR ***Type 3*** abatement procedures as best suited, based on constraints and limitations. All handling/removal procedures must comply with the requirements of O.Reg. 278/05 (as amended).

1. Action levels based on PWGSC DP 057 and are in compliance with Ontario and Federal regulations.
2. If the work is completed using conventional powered hand tools, work must follow **Type 3** procedures

A number of other materials throughout the subject building were previously identified or presumed to be asbestos-containing in *Pinchin's 2013 "Asbestos Assessment" Report*. These materials include: texture finish, pipe insulation, mechanical insulation, duct insulation, plaster, drywall joint compound, asbestos cement ("Transite"), vinyl sheet flooring, vinyl floor tile, and "Bakelite" laboratory countertops. Any work which may disturb or damage these materials if they are encountered during work in the subject areas or subject building must be performed in accordance with *O.Reg. 278/05*.

It should be noted that asbestos-containing materials (ACM) not identified in this report, or in the subject building's existing asbestos and hazardous materials survey report (Pinchin Report), may still be present and concealed by existing building components and/or finishes. If demolition or construction work activities uncover materials suspected of containing asbestos, all work must stop and the materials should be assessed by a competent person in order to determine asbestos content. If the material is identified as ACM it must be handled in accordance to the requirements of *O.Reg. 278/05*.

4.1.1 Presumed Asbestos-Containing Materials

In cases where a suspect material was inaccessible or where access to the material would require significant damage to the building materials or components, the material was presumed to be asbestos-containing until sampling of the material is feasible.

These materials should be treated as ACM, following the requirements of *O.Reg.278/05*, unless proven otherwise. Table 4 summarizes the presumed asbestos-containing materials in the subject areas.

Table 4 Summary of Presumed Asbestos-Containing Materials

Location	Material / Quantity	Assessment	Action[1]
2nd Floor Library	Fire-rated doors	- ***Sample ID***: N/A *(Presumed ACM)* - ***Concentration***: N/A - ***Material:*** Friable (applies to inner core material only) - ***Accessibility***: D *(Areas of the building which are inaccessible or where demolition is required to access the ACM)* - ***Condition***: Unknown	Prior to removal and disposal, collect inner core samples following **Type 2** procedures for determination of asbestos content. or Remove following ***Type 1*** procedures if the door is removed and disposed of in its entirety as ACM waste without disturbing inner core. All handling/removal procedures must comply with the requirements of *O.Reg. 278/05* (as amended).

1. Action levels based on PWGSC DP 057 and are in compliance with Ontario and Federal regulations.

4.1.2 Non Asbestos-Containing Materials

Table 5 summarizes the materials which were sampled, and subsequently identified as “non-asbestos”. These materials either contained no detectable concentrations of asbestos, or contained concentrations of asbestos below 0.5% concentration by weight, and therefore considered to be “non-asbestos” according to the definition in *O.Reg. 278/05*.

Table 5 Summary of Non Asbestos-Containing Materials

Material	Description	Sample ID[1]
Drywall Joint Compound	White drywall joint compound from walls, ceilings	CCIW – 1A,B,C
Mastic	Yellow/brown/black baseboard mastic adhesive	CCIW – 2A,B,C,D
Plaster	White/grey layers of plaster on walls, bulkheads	CCIW – 3A,B,C
Vinyl Baseboard	Black vinyl baseboards	CCIW – 4A,B,C,D
Caulking	White caulking around cinder block walls	CCIW – 5A,B,C
Ceiling Panel	2’x4’ Off-white with pinholes	CCIW – 6A,B,C
Ceiling Panel	2’x1’ Off-white with pinholes and texture	CCIW – 7A,B,C
Ceiling Panel	2’x4’ Black with pinholes	CCIW – 8A,B,C
Mastic	Yellow carpet adhesive	CCIW – 9A,B,C
Vinyl Floor Tile	12”x12” White vinyl floor tile with blue pattern	CCIW – 11A,B,C

1. For sample ID and concentration levels refer to Laboratory Certificates of Analysis.

4.2 Lead

Lead concentrations within ten different paint applications were found to exceed the threshold limit of 0.009% (lead by weight) established for this assignment and therefore, are considered to be "lead-containing" under the federal *Hazardous Products Act* (*Surface Coating Materials Regulation*). Details can be found in Table 6, below.

Table 6 Summary of Lead-Containing Paints

Location	Material Description	Assessment	Action[1]
Library Door	Beige paint application	- ***Sample ID:*** CCIW-L1 - ***Concentration***: *2.2 %* - ***Condition***: Good	In general, the following procedures are recommended when removing lead-containing materials, coatings and paint applications: - Follow ***Type 1*** – if the coating is to be removed with a chemical gel or paste; - Follow ***Type 2a*** – if the coating is to be removed by scraping or sanding using non-powered hand tools, or manual demolition of lead-painted building components by striking with sledgehammer or similar tool; - Follow ***Type 3a*** – if the coating is to be removed using power tools; or, - Follow ***Type 3b*** – if the coating is to be removed by abrasive blasting.
Library Walls, Doors	Purple paint application	- ***Sample ID:*** CCIW-L2 - ***Concentration***: *0.020 %* - ***Condition***: Good	
Library Walls, Door Frames	Black paint application	- ***Sample ID:*** CCIW-L3 - ***Concentration***: *0.12 %* - ***Condition***: Good	
Library Walls	Cream paint application	- ***Sample ID:*** CCIW-L4 - ***Concentration***: *0.056 %* - ***Condition***: Good	
Library Walls	White paint application	- ***Sample ID:*** CCIW-L5 - ***Concentration***: *0.057 %* - ***Condition***: Good	
Library Door	Light purple paint application	- ***Sample ID:*** CCIW-L6 - ***Concentration***: *0.18 %* - ***Condition***: Good	
Library Door	Orange paint application	- ***Sample ID:*** CCIW-L7 - ***Concentration***: *<0.020 %* - ***Condition***: Good	
Library Shelving	Black paint application	- ***Sample ID:*** CCIW-L8 - ***Concentration***: *<0.023 %* - ***Condition***: Good	
Library Shelving	Purple paint application	- ***Sample ID:*** CCIW-L9 - ***Concentration***: *<0.041 %* - ***Condition***: Good	
Mechanical Room	Green paint application on HVAC equipment and associated pipes	- ***Sample ID:*** CCIW-L11 - ***Concentration***: *3.9 %* - ***Condition***: Good / Poor	
Library Shelving	Off-white paint application	- ***Sample ID:*** CCIW-L10 - ***Concentration***: *<0.009 %* - ***Condition***: Good	No Action Required

1. Removal procedures based on the Ontario Ministry of Labor's "*Guideline for Lead on Construction Projects*" April 2011.

Work that will disrupt and/or pulverize (including drilling, cutting, grinding or abrading) lead-containing materials must follow the recommendations provided in the *Ministry of Labour Guideline for Lead on Construction Projects*, dated September 2004. In addition, the aforementioned painted surfaces (containing lead) should be handled with appropriate health and safety precautions so as to comply with requirements of the Designated Substances regulation, *O.Reg. 490/09*, and disposal of these materials must also comply with the requirements of *O.Reg. 347 – General – Waste Management*.

Lead is also assumed to be present in the solder joints of copper piping observed in the ceiling space throughout the surveyed areas. It is unlikely that any special action will be required during piping removal/replacement work unless the cutting of the pipes at joints is required.

4.3 Other Designated Substances and Hazardous Materials

GENIVAR's survey also included the following designated substances and hazardous materials as described in the survey methodology (Section 2.1). Table 7 summarizes these findings along with any associated recommended remedial actions.

Table 7 Other Designated Substances and Hazardous Materials identified within the Site

Material	Description	Action
Silica	Building components containing silica such as concrete floor and cinderblock wall were observed throughout the surveyed areas.	Work that disturbs silica-containing materials should comply with the requirements of *O.Reg. 490/09 - Silica*.
Mercury	Mercury is presumed to be present within fluorescent light tubes identified within the subject areas (approximately 150 light tubes).	Mercury vapour within light fixtures poses no risk to workers or occupants provided the mercury containment remains intact and undisturbed. Removal and disposal of mercury-containing equipment is required prior to demolition activities that may disturb the equipment. The handling, transport, and disposal of mercury containing equipment must follow all applicable provincial and federal regulations and guidelines pertaining to Mercury.
PCBs	Fluorescent light ballasts were observed within the subject areas. The majority of individual lamp ballasts were inspected during the survey, all of which were found to be "PCB-free". However, based on the building's date of construction, PCBs may be present in some of the lamp ballasts within the subject areas which were not able to be inspected (potentially 30 PCB-containing ballasts).	When decommissioned, verify the PCB content of fluorescent light ballasts as per the Environment Canada publication "Identification of Lamp Ballasts Containing PCBs", 1991. Handle, store and dispose of PCB-containing equipment and materials in accordance with applicable PCB regulations including Federal PCB Regulation SOR/2008-273.
ODS	ODS was not observed in the subject areas during the time of the survey. In buildings, ODSs are commonly found in refrigeration systems, halon fire extinguishers and air conditioning units.	Comply with Federal (*FHR 2003*) Provincial (*O.Reg. 189/94*) and Waste Management Regulations (*O.Reg. 347*) when handling and disposing of ODS.
Mould	Mould was not observed in the area of work during the time of the survey.	No action required.
Acrylonitrile	Acrylonitrile was not observed in the area of work during the time of the survey.	No action required.
Arsenic	Arsenic was not observed in the area of work during the time of the survey.	No action required.

Material	Description	Action
Benzene	Benzene was not observed in the area of work during the time of the survey.	No action required.
Coke Oven Emissions	Coke oven emissions were not observed in the area of work during the time of the survey.	No action required.
Ethylene Oxide	Ethylene oxide was not observed in the area of work during the time of the survey.	No action required.
Isocyanates	Isocyanates were not observed in the area of work during the time of the survey.	No action required.
Vinyl Chloride	Vinyl chloride was not observed in the area of work during the time of the survey.	No action required.

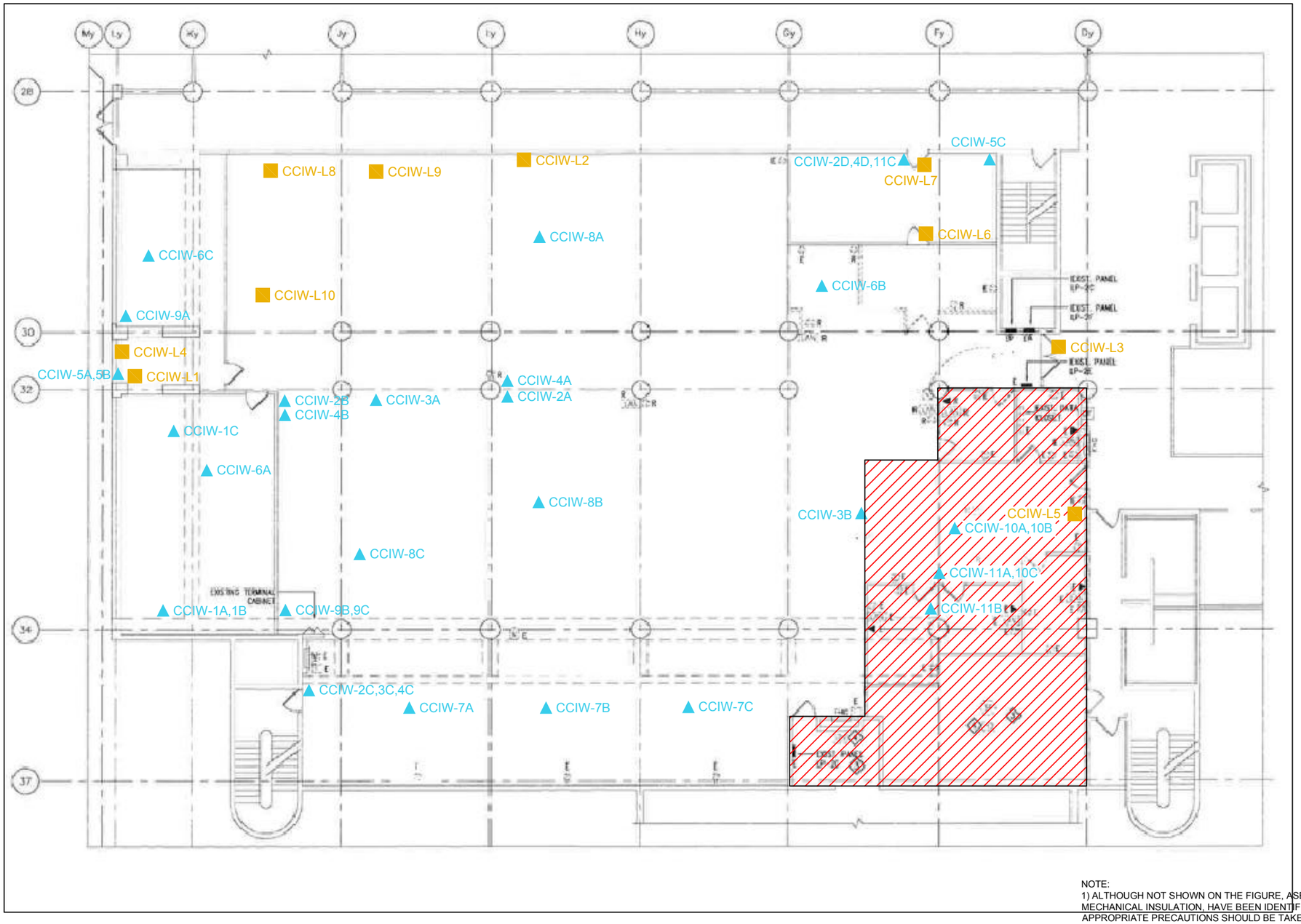
5. Closure

A Designated Substances and Hazardous Materials Survey (DSHMS) is intended to provide an owner or its authorized agent with a general summary of asbestos-containing materials (ACM) and other designated substances which includes their observed condition and their respective locations within a facility, as required under Ontario regulations.

GENIVAR Inc. warrants that the findings and conclusions contained herein have been prepared in accordance with generally accepted environmental survey methods. There is a possibility that materials may exist which could not be reasonably identified within the scope of the assessment or which were not apparent during the site visit. GENIVAR Inc. believes that the information collected during the survey is reliable. However, GENIVAR Inc. cannot warrant or guarantee that the information provided is absolutely complete or accurate beyond current environmental consulting standards. GENIVAR Inc. reserves the right to amend and/or supplement this report in the event that additional information or documentation becomes available.

Appendix A

Figures



NOTE:
1) ALTHOUGH NOT SHOWN ON THE FIGURE, ASBESTOS-CONTAINING MATERIALS, INCLUDING MECHANICAL INSULATION, HAVE BEEN IDENTIFIED THROUGHOUT THE SUBJECT BUILDING. APPROPRIATE PRECAUTIONS SHOULD BE TAKEN WHEN WORKING IN THE VICINITY OF THESE MATERIALS. SUSPECT MATERIALS SHOULD BE TREATED AS ASBESTOS-CONTAINING UNLESS PROVEN OTHERWISE.

Legend

- ▲ ASBESTOS BULK SAMPLE LOCATION
- ■ LEAD PAINT BULK SAMPLE LOCATION
- ASBESTOS-CONTAINING VINYL FLOOR TILE

Project No: 131-25127-00	
Scale: Not To Scale	
Date: December 2013	
Drawn By: SWH	
App'd By: CP	

Client:
PUBLIC WORKS AND GOVERNMENT SERVICES CANADA (PWGSC)

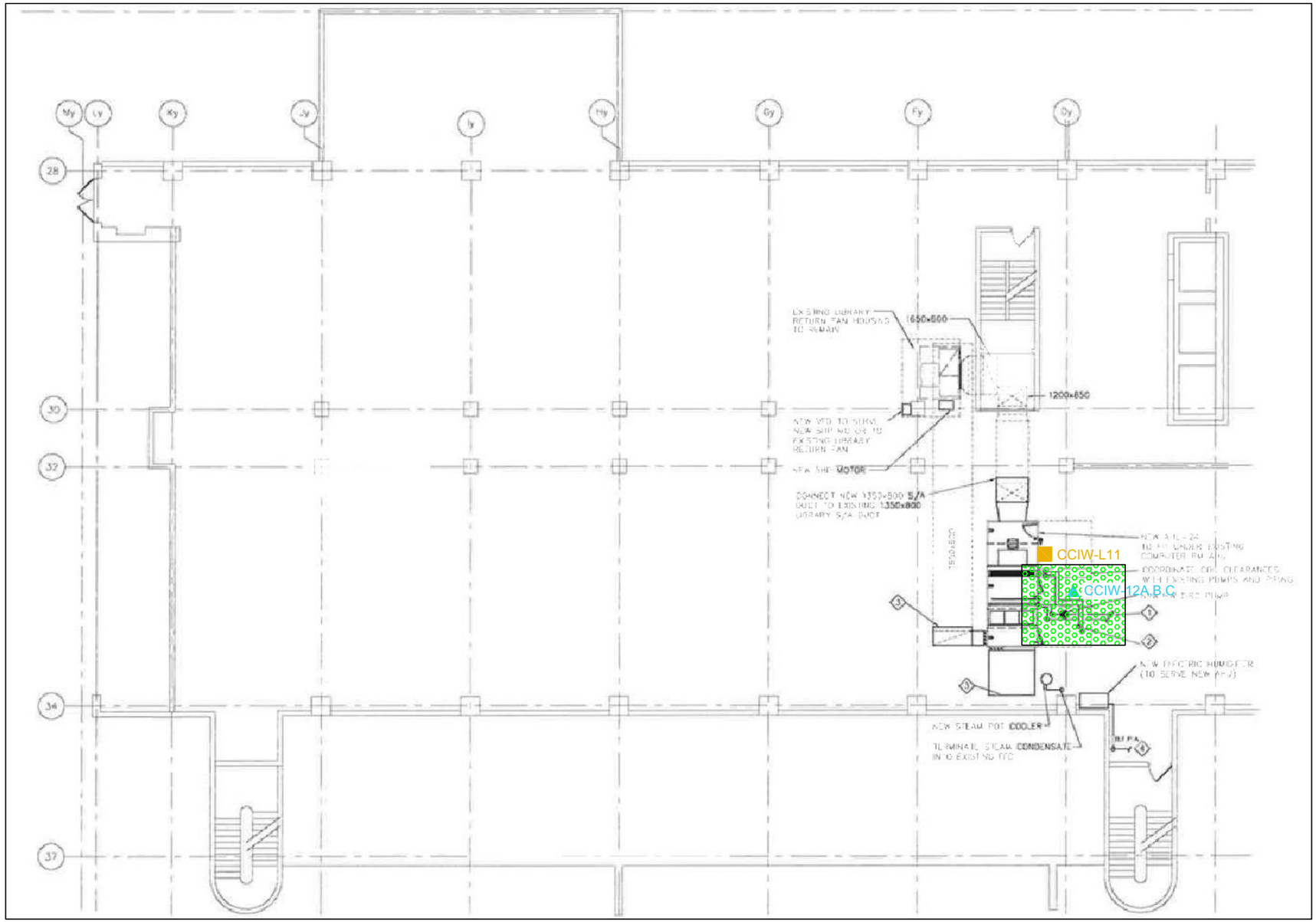
Site Address:
CANADA CENTRE FOR INLAND WATERS (CCIW)
867 LAKESHORE ROAD
BURLINGTON, ONTARIO

LOCATIONS OF ASBESTOS/LEAD BULK SAMPLES AND ASBESTOS-CONTAINING MATERIALS

SECOND FLOOR LIBRARY

Figure No: 1

GENIVAR



NOTE:
1) ALTHOUGH NOT SHOWN ON THE FIGURE, ASBESTOS-CONTAINING MECHANICAL INSULATION IS PRESENT THROUGHOUT THE MECHANICAL ROOM. IN ADDITION, A NUMBER OF OTHER MATERIALS THROUGHOUT THE BUILDING WERE PREVIOUSLY DETERMINED TO CONTAIN ASBESTOS. APPROPRIATE PRECAUTIONS SHOULD BE TAKEN WHEN WORKING IN THE VICINITY OF THESE MATERIALS. SUSPECT MATERIALS SHOULD BE TREATED AS ASBESTOS-CONTAINING UNLESS PROVEN OTHERWISE.

Legend

- ASBESTOS BULK SAMPLE LOCATION
- LEAD PAINT BULK SAMPLE LOCATION
- ASBESTOS-CONTAINING MECHANICAL INSULATION (PIPE ELBOWS, FLANGES)

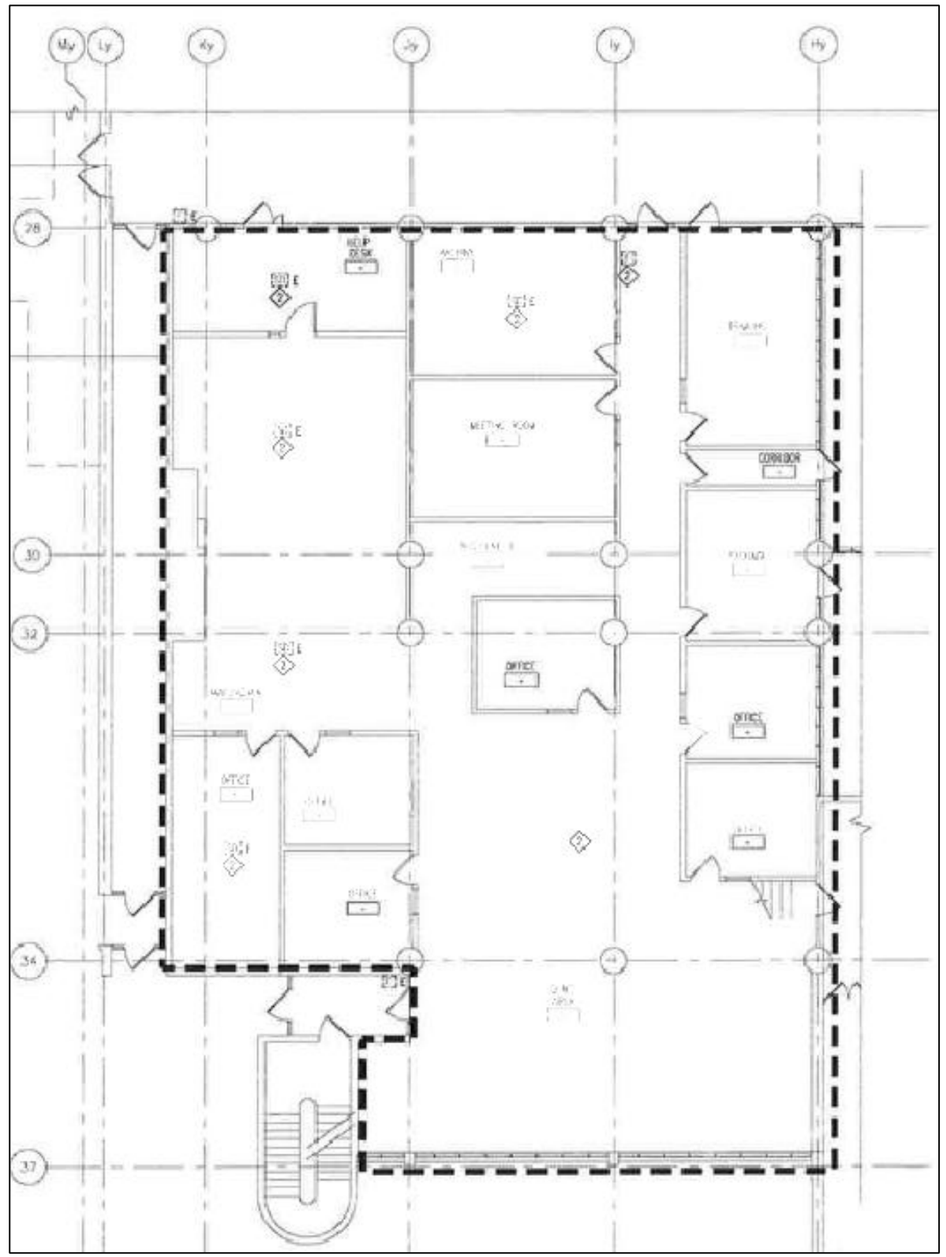
Project No: 131-25127-00	Client: PUBLIC WORKS AND GOVERNMENT SERVICES CANADA (PWGSC)
Scale: Not To Scale	
Date: December 2013	Site Address: CANADA CENTRE FOR INLAND WATERS (CCIW) 867 LAKESHORE ROAD BURLINGTON, ONTARIO
Drawn By: SWH	
App'd By: CP	

LOCATIONS OF ASBESTOS/LEAD BULK SAMPLES AND ASBESTOS-CONTAINING MATERIALS

THIRD FLOOR MECHANICAL ROOM

Figure No: **2**

GENIVAR



NOTE:
1) ALTHOUGH NOT SHOWN ON THE FIGURE, ASBESTOS-CONTAINING MATERIALS, INCLUDING MECHANICAL INSULATION, HAVE BEEN IDENTIFIED THROUGHOUT THE SUBJECT BUILDING. APPROPRIATE PRECAUTIONS SHOULD BE TAKEN WHEN WORKING IN THE VICINITY OF THESE MATERIALS. SUSPECT MATERIALS SHOULD BE TREATED AS ASBESTOS-CONTAINING UNLESS PROVEN OTHERWISE.

Legend

▲ ASBESTOS BULK SAMPLE LOCATION (NONE COLLECTED)

■ LEAD PAINT BULK SAMPLE LOCATION (NONE COLLECTED)

Project No: 131-25127-00	
Scale: Not To Scale	
Date: December 2013	
Drawn By: SWH	
App'd By: CP	

Client:
PUBLIC WORKS AND GOVERNMENT SERVICES CANADA (PWGSC)

Site Address:
CANADA CENTRE FOR INLAND WATERS (CCIW)
867 LAKESHORE ROAD
BURLINGTON, ONTARIO

LOCATIONS OF ASBESTOS/LEAD BULK SAMPLES AND ASBESTOS-CONTAINING MATERIALS

FIRST FLOOR OFFICE AREA

Figure No: **3**

GENIVAR

Appendix B

Laboratory Certificates of Analysis

EMSL Canada Inc.

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http://www.EMSL.com / torontolab@emsl.com

EMSL Canada Order 551308616
Customer ID: 55MACV62
Customer PO: 131-25127-00
Project ID:

Attn: Stephen Heikkila
GENIVAR Inc.
600 Cochrane Drive
L3R 5K3
Markham, ON L3R 5K3

Phone: (514) 386-1481
Fax: (905) 475-5994
Collected:
Received: 12/05/2013
Analyzed: 12/09/2013

Proj: PWGSC CCIW-131-25127-00

Test Report: Asbestos Analysis of Bulk Materials for Ontario Regulation 278/05 via EPA600/R-93/116 Method

Client Sample ID: CCIW-1A ***Lab Sample ID:*** **551308616-0001**
Sample Description: DRYWALL JOINT COMPOUND

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	12/06/2013	White	0%	100%	None Detected	

Client Sample ID: CCIW-1B ***Lab Sample ID:*** **551308616-0002**
Sample Description: DRYWALL JOINT COMPOUND

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	12/06/2013	White	0%	100%	None Detected	

Client Sample ID: CCIW-1C ***Lab Sample ID:*** **551308616-0003**
Sample Description: DRYWALL JOINT COMPOUND

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	12/09/2013	White	0%	100%	None Detected	

Client Sample ID: CCIW-2A ***Lab Sample ID:*** **551308616-0004**
Sample Description: BASEBOARD MASTIC

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	12/06/2013	Brown	0%	100%	None Detected	

Client Sample ID: CCIW-2B ***Lab Sample ID:*** **551308616-0005**
Sample Description: BASEBOARD MASTIC

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	12/06/2013	Brown	0%	100%	None Detected	

Client Sample ID: CCIW-2C ***Lab Sample ID:*** **551308616-0006**
Sample Description: BASEBOARD MASTIC

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	12/06/2013	Brown	0%	100%	None Detected	

Client Sample ID: CCIW-2D ***Lab Sample ID:*** **551308616-0006A**
Sample Description: BASEBOARD MASTIC

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	12/09/2013	Gray/Tan	0%	100%	None Detected	

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Project ID:

Test Report: Asbestos Analysis of Bulk Materials for Ontario Regulation 278/05 via EPA600/R-93/116 Method

Client Sample ID: CCIW-3A ***Lab Sample ID:*** **551308616-0007**
Sample Description: PLASTER

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	12/06/2013	Gray/White	0%	100%	None Detected	

Client Sample ID: CCIW-3B ***Lab Sample ID:*** **551308616-0008**
Sample Description: PLASTER

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	12/06/2013	Gray/White	0%	100%	None Detected	

Client Sample ID: CCIW-3C ***Lab Sample ID:*** **551308616-0009**
Sample Description: PLASTER

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	12/09/2013	Gray/White	0%	100%	None Detected	

Client Sample ID: CCIW-4A ***Lab Sample ID:*** **551308616-0010**
Sample Description: VINYL BASEBOARD

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	12/06/2013	Black	0%	100%	None Detected	
TEM Grav. Reduction	12/09/2013	Brown	0.0%	100%	None Detected	

Client Sample ID: CCIW-4B ***Lab Sample ID:*** **551308616-0011**
Sample Description: VINYL BASEBOARD

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	12/06/2013	Black	0%	100%	None Detected	
TEM Grav. Reduction	12/09/2013	Brown	0.0%	100%	None Detected	

Client Sample ID: CCIW-4C ***Lab Sample ID:*** **551308616-0012**
Sample Description: VINYL BASEBOARD

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	12/06/2013	Black	0%	100%	None Detected	
TEM Grav. Reduction	12/09/2013	Brown	0.0%	100%	None Detected	

Client Sample ID: CCIW-5A ***Lab Sample ID:*** **551308616-0013**
Sample Description: CAULKING

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	12/06/2013	White	0%	100%	None Detected	

Client Sample ID: CCIW-5B ***Lab Sample ID:*** **551308616-0014**
Sample Description: CAULKING

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	12/06/2013	White	0%	100%	None Detected	

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Customer PO: 131-25127-00
Project ID:

Test Report: Asbestos Analysis of Bulk Materials for Ontario Regulation 278/05 via EPA600/R-93/116 Method

Client Sample ID: CCIW-5C ***Lab Sample ID:*** **551308616-0015**
Sample Description: CAULKING

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	12/09/2013	White	0%	100%	None Detected	

Client Sample ID: CCIW-6A ***Lab Sample ID:*** **551308616-0016**
Sample Description: CEILING PANEL-OFF-WHITE W/PINHOLES

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	12/06/2013	Gray/White	80%	20%	None Detected	

Client Sample ID: CCIW-6B ***Lab Sample ID:*** **551308616-0017**
Sample Description: CEILING PANEL-OFF-WHITE W/PINHOLES

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	12/06/2013	Gray/White	0%	100%	None Detected	

Client Sample ID: CCIW-6C ***Lab Sample ID:*** **551308616-0018**
Sample Description: CEILING PANEL-OFF-WHITE W/PINHOLES

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	12/09/2013	Tan/White	80%	20%	None Detected	

Client Sample ID: CCIW-7A ***Lab Sample ID:*** **551308616-0019**
Sample Description: CEILING PANEL-OFF-WHITE W/PINHOLES & TEXTURE

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	12/06/2013	Gray/White	80%	20%	None Detected	

Client Sample ID: CCIW-7B ***Lab Sample ID:*** **551308616-0020**
Sample Description: CEILING PANEL-OFF-WHITE W/PINHOLES & TEXTURE

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	12/06/2013	Gray/White	80%	20%	None Detected	

Client Sample ID: CCIW-7C ***Lab Sample ID:*** **551308616-0021**
Sample Description: CEILING PANEL-OFF-WHITE W/PINHOLES & TEXTURE

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	12/09/2013	Tan/White	80%	20%	None Detected	

Client Sample ID: CCIW-8A ***Lab Sample ID:*** **551308616-0022**
Sample Description: CEIING PANEL-BLACK WITH PINHOLES

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	12/06/2013	Gray/Black	80%	20%	None Detected	

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Customer ID: 55MACV62
Customer PO: 131-25127-00
Project ID:

Test Report: Asbestos Analysis of Bulk Materials for Ontario Regulation 278/05 via EPA600/R-93/116 Method

Client Sample ID: CCIW-8B ***Lab Sample ID:*** **551308616-0023**
Sample Description: CEIING PANEL-BLACK WITH PINHOLES

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	12/06/2013	Gray/Black	80%	20%	None Detected	

Client Sample ID: CCIW-8C ***Lab Sample ID:*** **551308616-0024**
Sample Description: CEIING PANEL-BLACK WITH PINHOLES

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	12/09/2013	Tan/White	80%	20%	None Detected	

Client Sample ID: CCIW-9A ***Lab Sample ID:*** **551308616-0025**
Sample Description: CARPET ADHESIVE

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	12/06/2013	Black/Yellow	0%	100%	None Detected	

Client Sample ID: CCIW-9B ***Lab Sample ID:*** **551308616-0026**
Sample Description: CARPET ADHESIVE

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	12/06/2013	Black/Yellow	0%	100%	None Detected	

Client Sample ID: CCIW-9C ***Lab Sample ID:*** **551308616-0027**
Sample Description: CARPET ADHESIVE

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	12/09/2013	Black	0%	100%	None Detected	

Client Sample ID: CCIW-10A ***Lab Sample ID:*** **551308616-0028**
Sample Description: VINYL FLOOR TILE-12" BEIGE W/BLACK STREAKS

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	12/06/2013	White	0%	95%	**5% Chrysotile**	

Client Sample ID: CCIW-10B ***Lab Sample ID:*** **551308616-0029**
Sample Description: VINYL FLOOR TILE-12" BEIGE W/BLACK STREAKS

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	12/06/2013				Stop Positive (Not Analyzed)	

Client Sample ID: CCIW-10C ***Lab Sample ID:*** **551308616-0030**
Sample Description: VINYL FLOOR TILE-12" BEIGE W/BLACK STREAKS

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	12/06/2013				Stop Positive (Not Analyzed)	

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Project ID:

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Client Sample ID: CCIW-11A ***Lab Sample ID:*** **551308616-0031**
Sample Description: VINYL FLOOR TILE-12" WHITE W/ BLUE PATTERN

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	12/06/2013	White	0%	100%	None Detected	
TEM Grav. Reduction	12/09/2013	White /Various	0.0%	100%	None Detected	

Client Sample ID: CCIW-11B ***Lab Sample ID:*** **551308616-0032**
Sample Description: VINYL FLOOR TILE-12" WHITE W/ BLUE PATTERN

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	12/06/2013	White	0%	100%	None Detected	
TEM Grav. Reduction	12/09/2013	White /Various	0.0%	100%	None Detected	

Client Sample ID: CCIW-11C ***Lab Sample ID:*** **551308616-0033**
Sample Description: VINYL FLOOR TILE-12" WHITE W/ BLUE PATTERN

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	12/06/2013	White	0%	100%	None Detected	
TEM Grav. Reduction	12/09/2013	White /Various	0.0%	100%	None Detected	

Client Sample ID: CCIW-12A ***Lab Sample ID:*** **551308616-0034**
Sample Description: VALVE INSULATION

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	12/06/2013	/hite/Various/Yello	50%	50%	None Detected	

Client Sample ID: CCIW-12B ***Lab Sample ID:*** **551308616-0035**
Sample Description: VALVE INSULATION

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	12/06/2013	/hite/Various/Yello	10%	60%	**30% Chrysotile**	

Client Sample ID: CCIW-12C ***Lab Sample ID:*** **551308616-0036**
Sample Description: VALVE INSULATION

TEST	Analyzed Date	Color	Non-Asbestos Fibrous	Non-Asbestos Non-Fibrous	Asbestos	Comment
PLM	12/06/2013				Stop Positive (Not Analyzed)	

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EMSL Canada Order 551308616
Customer ID: 55MACV62
Customer PO: 131-25127-00
Project ID:

Test Report: Asbestos Analysis of Bulk Materials for Ontario Regulation 278/05 via EPA600/R-93/116 Method

Analyst(s)

Arabee Sathiaseelan	PLM	(26)
Matthew Davis	PLM	(8)
	TEM Grav. Reduction	(6)

Kevin Pang
or other Approved Signatory

Any questions please contact Kevin Pang.

Samples analyzed by EMSL Canada Inc. Mississauga, ON NVLAP Lab Code 200877-0

Initial report from: 12/09/201313:59:44

EMSL Canada Inc.
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EMSL Canada Or	551308622
CustomerID:	55MACV62
CustomerPO:	131-25127-00
ProjectID:	

Attn: **Stephen Heikkila**
GENIVAR Inc.
600 Cochrane Drive
L3R 5K3
Markham, ON L3R 5K3

Phone: (514) 386-1481
Fax: (905) 475-5994
Received: 12/05/13 5:26 PM
Collected:

Project: **PWGSC CCIW-131-25127-00**

Test Report: Lead in Paint Chips by Flame AAS (SW 846 3050B*/7000B)

Client Sample Description	*Lab ID*	*Collected*	*Analyzed*	*Lead Concentration*
CCIW-L1	*0001*		12/9/2013	2.2 % wt
	Site: BEIGE			
CCIW-L2	*0002*		12/9/2013	0.020 % wt
	Site: PURPLE			
CCIW-L3	*0003*		12/9/2013	0.12 % wt
	Site: BLACK			
CCIW-L4	*0004*		12/9/2013	0.056 % wt
	Site: CREAM			
CCIW-L5	*0005*		12/9/2013	0.057 % wt
	Site: WHITE			
CCIW-L6	*0006*		12/9/2013	0.18 % wt
	Site: LIGHT PURPLE			
CCIW-L7	*0007*		12/9/2013	<0.020 % wt
	Site: ORANGE INSUFFICIENT SAMPLE TO REACH REPORTING LIMIT.			
CCIW-L8	*0008*		12/9/2013	<0.023 % wt
	Site: BLACK-BOOKSHELF INSUFFICIENT SAMPLE TO REACH REPORTING LIMIT.			
CCIW-L9	*0009*		12/9/2013	<0.041 % wt
	Site: PURPLE-BOOKSHELF INSUFFICIENT SAMPLE TO REACH REPORTING LIMIT.			
CCIW-L10	*0010*		12/9/2013	<0.0090 % wt
	Site: OFFWHITE-BOOK SHELF			
CCIW-L11	*0011*		12/9/2013	3.9 % wt
	Site: GREEN			

Kevin Pang
or other approved signatory

Reporting limit is 0.010 % wt based on the minimum sample weight per our SOP. The QC data associated with these results included in this report meet the method QC requirements, unless specifically indicated otherwise. Unless noted, results in this report are not blank corrected. EMSL bears no responsibility for sample collection activities. Samples received in good condition unless otherwise noted.
* slight modifications to methods applied. "<" (less than) result signifies that the analyte was not detected at or above the reporting limit. Measurement of uncertainty is available upon request.

Samples analyzed by EMSL Canada Inc. Mississauga, ON A2LA Accredited Environmental Testing Cert #2845.08

Initial report from 12/10/2013 10:22:54

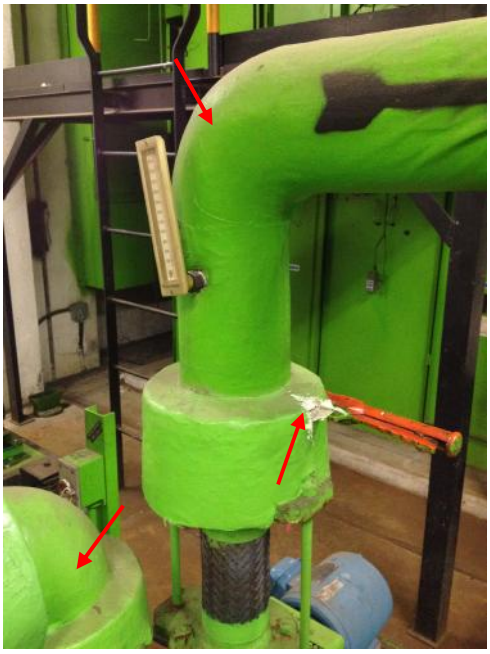
Appendix C

Project Photographs

Photograph 1: Exterior view of CCIW Administration Building.

Photograph 2: [2nd Floor Library] Asbestos-containing 12”x12” beige vinyl floor tiles with black streaks in the kitchen and office area of the library (Sample Set CCIW-10).

Photograph 3: [3rd Floor Mechanical Room] View of asbestos-containing mechanical insulation on pipe elbows, flanges and valves (Sample Set CCIW-12).

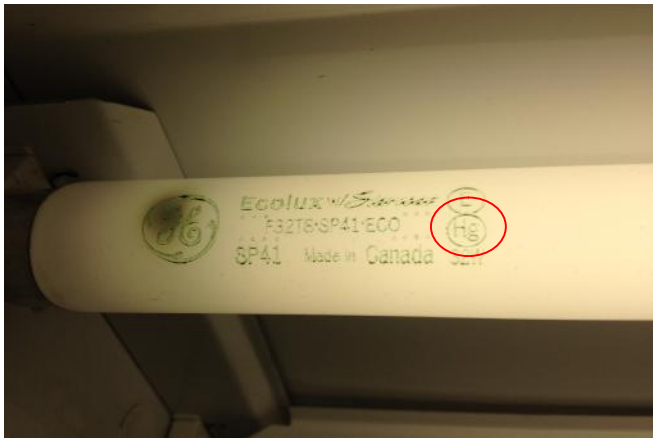


Photograph 4: [3rd Floor Mechanical Room] View of asbestos-containing mechanical insulation on elbows flanges. Also, the thermometers in the area are suspected to contain mercury, and the green paint on the mechanical equipment was found to be lead-containing (Sample ID CCIW-L11).

Photograph 5: [2nd Floor Library] Lead-containing paint applications: purple on walls/doors (Sample ID CCIW-L2), black on walls/door frames (Sample ID CCIW-L3), and white on cinder block walls (Sample ID CCIW-L5).

Photograph 6: [Ground Floor Office Area] Fibreglass insulation with foil wrap on ducts and pipes, observed throughout subject areas, which is non-asbestos-containing.

Photograph 7: [2nd Floor Library] Fluorescent light ballast displaying "No PCBs" signage. Most ballasts in the subject areas were observed to be PCB-free, but it is possible that some ballasts contain PCBs.



Photograph 8: [2nd Floor Library] Fluorescent light tubes throughout the subject areas were observed to contain mercury.

Appendix D

Asbestos-Containing Material Evaluation Criteria

Asbestos-Containing Material Evaluation Criteria

A description of the criteria used in evaluating the condition, accessibility and exposure risk of asbestos-containing materials (ACM) is provided below. The criteria is generally based on the Public Works and Government Services Canada (PWGSC) document entitled "Deputy Ministers Directive 057 – Asbestos Management" (1997-12-03) and industry standards of practice.

Assessment of Condition

Spray-Applied Fireproofing, Insulation and Textured Finishes

In evaluating the condition of ACM spray applied as fireproofing, thermal insulation or texture, decorative or acoustic finishes, the following criteria apply:

Good
Surface of material shows no significant signs of damage, deterioration or delamination. Up to one percent visible damage to surface is allowed within range of GOOD. Evaluation of sprayed fireproofing requires the Assessor to be familiar with the irregular surface texture typical of sprayed asbestos products. GOOD condition includes unencapsulated or unpainted fireproofing or texture finishes, where no delamination or damage is observed, and encapsulated fireproofing or texture finishes where the encapsulation has been applied after the damage or fallout occurred.

Poor
Sprayed materials show signs of damage, delamination or deterioration. More than one percent damage to surface of ACM spray.

In observation areas, where damage exists in isolated locations, both GOOD and POOR condition may be reported. The extent or percentage of each condition will be recorded on the Assessor reassessment form.

FAIR condition is not utilized or considered as a valid criterion in the evaluation of sprayed fireproofing, sprayed insulation, or texture coat finishes.

The evaluation of ACM spray applied as fireproofing, non-mechanical thermal insulation, or texture, decorative or acoustic finishes which are present above ceilings, may be limited by the number of observations made, and by building components such as ducts or full height walls that obstruct the above ceiling observations. Persons entering the ceiling area are advised to be watchful for ACM DEBRIS prior to accessing or working above ceilings in areas of building with ACM, regardless of the reported condition.

Other ACM

In evaluating the condition of mechanical insulation (on boilers, breaching, ductwork, piping, tanks, equipment etc.) the following criteria are used:

Good
Insulation is completely covered in jacketing and exhibits no evidence of damage or deterioration. No insulation is exposed. Includes conditions where the jacketing has minor surface damage (i.e., scuffs or stains), but the jacketing is not penetrated.

Fair
Minor penetration damage to jacketed insulation (cuts, tears, nicks, deterioration or delamination) or undamaged insulation that has never been jacketed. Insulation is exposed but not showing surface disintegration. The extent of missing insulation ranges should be minor to none.

Poor
Original insulation jacket is missing, damaged, deteriorated or delaminated. Insulation is exposed and significant areas have been dislodged. Damage cannot be readily repaired. The evaluation of mechanical insulation may be limited by the number of observations made and building components such as ducts or full height walls that obstruct observations. In these circumstances, it is not possible to observe each foot of mechanical insulation from all angles.

Non-Friable and Potentially Friable Materials

Non-friable materials generally have little potential to release airborne fibres, even when damaged by mechanical breakage. However, some non-friable materials, i.e., exterior asbestos cement products, may have deteriorated so that the binder no longer effectively contains the asbestos fibres. In such cases of significantly deteriorated non-friable material, the material will be treated as a friable product.

Evaluation of Accessibility

The accessibility of building materials known or suspected of being ACM is rated according to the following criteria:

Access (A)
Areas of the building within reach of all building users. Includes areas such as gymnasiums, workshops, and storage areas where activities of the building users may result in disturbance of ACM not normally within reach from floor level.

Access (B)
Frequently entered maintenance areas within reach of maintenance staff, without the need for a ladder. Includes: frequently entered pipe chases, tunnels and service areas or areas within reach from a fixed ladder or catwalk, i.e., tops of equipment, mezzanines.

Access (C) Exposed
Areas of the building above 8'0" where use of a ladder is required to reach the ACM. Only refers to ACM materials that are exposed to view, from the floor or ladder, without removing or opening other building components such as ceiling tiles, or service access doors or hatches. Does not include infrequently accessed service areas of the building.

Access (C) Concealed
Areas of the building which require the removal of a building component, including lay-in ceilings and access panels into solid ceiling systems. Includes rarely entered crawl spaces, attic spaces, etc. Observations are limited to the extent visible from the access points.

Access (D)
Areas of the building behind inaccessible solid ceiling systems, walls, or mechanical equipment, etc. where demolition of the ceiling, wall or equipment, etc., is required to reach the ACM. Evaluation of the condition and extent of ACM is limited or impossible, depending on the Assessor's ability to visually examine the materials in Access D.

Definition of Action Levels

Based on the results of the inspection and bulk sample analysis of samples collected and submitted for testing, recommendations were provided for compliance with regulation. These include assigned "Action Levels" to assist in the prioritization of corrective measures. The measures that are to be taken for each "Action Level" are described in full in the following table:

Action Level	Required Action
"Action 1"	**Immediate Clean-Up of Debris that is Likely to Be Disturbed** Restrict access that is likely to cause a disturbance of the ACM DEBRIS and clean up ACM DEBRIS immediately. Utilize correct asbestos procedures. This action is required for compliance with regulatory requirements. The surveyor will immediately notify the owner of this condition.
"Action 2"	**Type 2 Precautions for Entry into Areas with ACM DEBRIS** At locations where ACM DEBRIS can be isolated in lieu of removal or cleaned up, use appropriate means to limit entry to the area. Restrict access to the area to persons utilizing Type 2 asbestos precautions. The precautions will be required until the ACM DEBRIS has been cleaned up, and the source of the DEBRIS has been stabilized or removed.
"Action 3"	**ACM Removal Required for Compliance** Remove ACM for compliance with regulatory requirements. Utilize asbestos procedures appropriate to the scope of the removal work.
"Action 4"	**Type 2 Precautions for Access into Areas Where ACM is Present and Likely to be Disturbed by Access** Use Type 2 asbestos precautions when entry or access into an area is likely to disturb the ACM. ACTION 4 must be used until the ACM is removed (Use ACTION 1 or 2 if DEBRIS is present).
"Action 5"	**Proactive ACM Removal** Remove ACM in lieu of repair, or at locations where the presence of asbestos in GOOD condition is not desirable.
"Action 6"	**ACM Repair** Repair ACM found in FAIR condition, and not likely to be damaged again or disturbed by normal use of the area or room. Upon completion of the repair work, treat ACM as material in GOOD condition and implement ACTION 7. If ACM is likely to be damaged or disturbed, during normal use of the area or room, implement ACTION 5.
"Action 7"	**Asbestos Management Program with Routine Surveillance** Implement an Asbestos Management Program, including routine surveillance of ACM. Trained workers or contractors must use appropriate asbestos precautions (Type 1, Type 2 or Type 3) during disturbance of the remaining ACM.
"Action 8"	**Suspect Materials** Implement the Asbestos Management Program for building materials that historically contained asbestos but cannot, or have not, been sufficiently tested for asbestos content. These materials are identified as SUSPECT MATERIALS.