Public Works and Government Services Canada

Requisition Number: EZ899-202956

MERX I.D. Number: _____

SPECIFICATIONS for:

RCMP TOFINO HRV
450 GIBSON STREET
TOFINO, BC
Project No: R.105895.001

Issued for Tender

APPROVED BY:

Mehrabadi, Behzad
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Project Manager — Date

END OF SECTION 00 00 10

CONSULTANTS – SEAL & SIGNATURE

Discipline	**Seal/Signature/Date**
Architectural Chernoff Thompson Architects	Tony Yip Dec 23, 2019
Mechanical Consultant AME Group	DEC 23 2019
Electrical Consultant O'M Engineering Electrical and Electronic Consulting Engineers	M. KHAN DEC 23 2019

END OF SECTION 00 01 07

Part 1 General

1.1 RELATED REQUIREMENTS

.1 This section of the Specification forms part of the Contract Documents and is to be read, interpreted, and coordinated with all other parts.

1.2 WORK COVERED BY CONTRACT DOCUMENTS

.1 Work of this Contract comprises renovation of a Royal Canadian Mounted Police residence, located at 450 Gibson Street, Tofino, BC.

.2 Prior to commencing with the renovation work, some hazmat abatement is required. Clean mould contamination from asbestos-containing ceiling texture coating in the Southeast Bedroom and Corner Bedroom areas in the building. Mould contaminated roof sheeting and framing exists in the attic space. Attic insulation will require removal in conjunction with mould remediation work. Perform work in accordance with Health Canada and WorkSafeBC requirements.

.3 Replace an existing heat recovery ventilator and associated ductwork and grilles with two new heat recovery ventilators and associated ducts and grilles.

.4 Renovate an existing kitchen. Convert an existing bedroom into a new kitchen.

.5 Convert an existing utility room into a new bathroom.

.6 Add a new laundry closet and install a new stacking washer and dryer.

.7 Replace the incoming domestic water service from the street main.

.8 Refer to drawings and specifications for full architectural, electrical and mechanical scope of work.

1.3 CONTRACT METHOD

.1 Construct Work under single lump sum contract.

.2 Relations and responsibilities between Contractor and subcontractors and subcontractors assigned by Departmental Representative are as defined in Conditions of Contract. Assigned Subcontractors must, in addition:

.1 Furnish to Contractor, bonds covering faithful performance of subcontracted work and payment of obligations thereunder.

.2 Purchase and maintain liability insurance to protect Contractor from claims for not less than limits of liability which Contractor is required to provide to Departmental Representative.

1.4 WORK SEQUENCE

.1 Co-ordinate Progress Schedule.

.2 Maintain fire access/control.

1.5 CONTRACTOR USE OF PREMISES

.1 Unrestricted use of site until Substantial Performance.

.2 Co-ordinate use of premises under direction of Departmental Representative.

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

.4 Remove or alter existing work to prevent injury or damage to portions of existing work which remain.

.5 Repair or replace portions of existing work which have been altered during construction operations to match existing or adjoining work, as directed by Departmental Representative.

.6 At completion of operations condition of existing work: equal to or better than that which existed before new work started.

1.6 ALTERATIONS, ADDITIONS OR REPAIRS TO EXISTING BUILDING

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

.2 Use only stairs existing in building for moving workers and material.

.1 Protect walls to approval of Departmental Representative prior to use.

.2 Accept liability for damage, safety and overloading of existing stairs.

1.7 EXISTING SERVICES

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

.2 Where Work involves breaking into or connecting to existing services, give Departmental Representative 48 hours notice for necessary interruption of mechanical or electrical service throughout course of work. Minimize duration of interruptions. Carry out work at times as directed by governing authorities with minimum disturbance to tenant operations.

.3 Provide alternative routes for personnel and vehicular traffic.

.4 Establish location and extent of service lines in area of work before starting Work. Notify Departmental Representative of findings.

.5 Submit schedule to and obtain approval from Departmental Representative for any shut-down or closure of active service or facility including power and communications services. Adhere to approved schedule and provide notice to affected parties.

.6 Provide temporary services to maintain critical building and tenant systems.

.7 Provide adequate bridging over trenches which cross sidewalks or roads to permit normal traffic.

.8 Where unknown services are encountered, immediately advise Departmental Representative and confirm findings in writing.

.9 Protect, relocate or maintain existing active services. When inactive services are encountered, cap off in manner approved by authorities having jurisdiction.

.10 Record locations of maintained, re-routed and abandoned service lines.

.11 Construct barriers in accordance with Section 01 56 00 - Temporary Barriers and Enclosures.

1.8 DOCUMENTS REQUIRED

.1 Maintain at job site, one copy each document as follows:

- .1 Contract Drawings.
- .2 Specifications.
- .3 Addenda.
- .4 Reviewed Shop Drawings.
- .5 List of Outstanding Shop Drawings.
- .6 Change Orders.
- .7 Other Modifications to Contract.
- .8 Field Test Reports.
- .9 Copy of Approved Work Schedule.
- .10 Health and Safety Plan and Other Safety Related Documents.
- .11 Other documents as specified.

Part 2 Products

2.1 NOT USED

.1 Not used.

Part 3 Execution

3.1 NOT USED

.1 Not used.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 This section of the Specification forms part of the Contract Documents and is to be read, interpreted, and coordinated with all other parts.

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 stairs existing in building for moving workers and material.

.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 and 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.

.3 Provide for personnel and vehicular traffic.

.4 Construct barriers in accordance with Section 01 56 00 - Temporary Barriers and Enclosures.

1.6 SPECIAL REQUIREMENTS

.1 Carry out noise generating Work in compliance with applicable noise bylaw.

.2 Submit schedule in accordance with Section 01 32 16.06 - Construction Progress Schedule - Critical Path Method (CPM).

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

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

.5 Ingress and egress of Contractor vehicles at site is not limited to time of day.

1.7 SECURITY

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

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 OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 This section of the Specification forms part of the Contract Documents and is to be read, interpreted, and coordinated with all other parts.

1.2 ADMINISTRATIVE

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

.2 Prepare agenda for meetings.

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

.4 Provide physical space and make arrangements for meetings.

.5 Preside at meetings.

.6 Departmental Representative will record the meeting minutes, include significant proceedings and decisions, and identify actions by parties.

.7 Departmental Representative will reproduce and distribute copies of minutes within five business days after meetings and transmit to 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.

1.3 PRECONSTRUCTION MEETING

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

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

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

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

.5 Agenda to include:

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

.2 Schedule of Work: in accordance with Section 01 32 16.06 - Construction Progress Schedule - Critical Path Method (CPM).

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

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

.5 Delivery schedule of specified equipment.

.6 Site security in accordance with Section 01 56 00 - Temporary Barriers and Enclosures.

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

.8 Departmental Representative provided products.

.9 Record drawings in accordance with Section 01 33 00 - Submittal Procedures.

.10 Maintenance manuals in accordance with Section 01 78 00 - Closeout Submittals.

.11 Take-over procedures, acceptance, warranties in accordance with Section 01 78 00 - Closeout Submittals.

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

.13 Appointment of inspection and testing agencies or firms.

.14 Insurances, transcript of policies.

1.4 PROGRESS MEETINGS

.1 During course of Work and two weeks prior to project completion, schedule progress meetings monthly.

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

.3 Notify parties minimum five days prior to meetings.

.4 Departmental Representative will record minutes of meetings and circulate to attending parties and affected parties not in attendance within five business days after meeting.

.5 Agenda to include the following:

.1 Review, approval of minutes of previous meeting.

.2 Review of Work progress since previous meeting.

.3 Field observations, problems, conflicts.

.4 Problems which impede construction schedule.

.5 Review of off-site fabrication delivery schedules.

.6 Corrective measures and procedures to regain projected schedule.

.7 Revision to construction schedule.

.8 Progress schedule, during succeeding work period.

.9 Review submittal schedules: expedite as required.

.10 Maintenance of quality standards.

.11 Review proposed changes for affect on construction schedule and on completion date.

.12 Other business.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 This section of the Specification forms part of the Contract Documents and is to be read, interpreted, and coordinated with all other parts.

1.2 REFERENCES

.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.

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

.4 Cash Flow: projection of progress payment requests based on cash loaded construction schedule.

.5 Completion Milestones: they are firstly Interim Certificate and secondly Final Certificate.

.6 Constraint: applicable restriction or limitation, either internal or external to project, that will affect performance of Project. Factors that affect activities can be scheduled.

.7 Control: process of comparing actual performance with planned performance, analyzing variances, evaluating possible alternatives, and taking appropriate corrective action as needed.

.8 Critical Activity: any activity on a critical path.

.1 Most commonly determined by using critical path method.

.9 Critical Path: sequence of activities that determines duration of Project. Generally, it is the longest path through Project.

.1 Usually defined as those activities with float less than or equal to specified value, often zero.

.10 Critical Path Method (CPM): network analysis technique used to determine the amount of scheduling flexibility (amount of float) on various logical network paths in Project schedule network, and to determine the minimum total Project duration.

.11 Data Date: date through which project status and progress were last determined and reported for analyses, such as scheduling and performance measurements.

.12 Duration: total number of work periods (not including holidays or other non-working periods) required to complete activity or other Project element.

.1 Usually expressed as workdays or work weeks.

.13 Early Finish Date: in critical path method, earliest possible point in time on which uncompleted portions of activity (or Project) can finish, based on network logic and schedule constraints.

.1 Early finish dates can change as Project progresses and changes are made to Project plan.

.14 Early Start Date: in critical path method, earliest possible point in time on which uncompleted portions of activity (or Project) can start, based on network logic and schedule constraints.

.1 Early start dates can change as Project progresses and changes are made to Project Plan.

.15 Finish Date: point in time associated with activity's completion.

.1 Usually qualified by one of following: actual, planned, estimated, scheduled, early, late, baseline, target, or current.

.16 Float: amount of time that activity may be delayed from its early start without delaying Project finish date.

.1 This resource is available to both Departmental Representative and Contractor.

.17 Impact Analysis: schedule analysis technique that adds a modeled delay to an accepted construction schedule to determined possible outcome of that delay on project completion.

.18 Lag: modification of logical relationship that directs delay in successor activity.

.19 Late Finish Date (LF): in critical path method, latest possible point in time that activity may be completed without delaying specified milestone (usually Project finish date).

.20 Late Start Date (LS): in critical path method, latest possible point in time that activity may begin without delaying specified milestone (usually Project finish date).

.21 Lead: modification of logical relationship that allows acceleration of successor task.

.22 Logic Diagram: see Project network diagram.

.23 Master Schedule: summary-level schedule that identifies major deliverable; work breakdowns structure and key milestones.

.24 Milestone: significant point or event in Project, usually completion of major deliverable.

.25 Monitoring: capture, analysis, and reporting of Project performance, usually as compared to plan.

.26 Non-Critical Activities: activities which when delayed, do not affect specified Contract duration.

.27 Project Control System: fully computerized system utilizing commercially available software packages.

.28 Project Network Diagram: schematic display of logical relationships of Project activities.

.1 Always drawn from left to right to reflect Project chronology.

.29 Project Plan: formal, approved document used to guide both Project execution and Project control.

.1 Primary uses of Project plan are to document planning assumptions and decisions, facilitate communication among stakeholders, and document approved scope, cost, and schedule baselines.

.2 Project plan may be summary or detailed.

.30 Project Planning: development and maintenance of Project Plan.

.31 Project Planning, Monitoring and Control System: overall system operated to enable monitoring of Project Work in relation to established milestones.

.32 Project Schedule: planned dates for performing activities and planned dates for meeting milestones.

.33 Quantified days duration: working days based on 5 day work week, discounting statutory holidays.

.34 Risk: uncertain event or condition that, if it occurs, has positive or negative effect on Project's objectives.

.35 Start Date: point in time associated with activity's start, usually qualified by one of following: actual, planned, estimated, scheduled, early, late, target, baseline, or current.

.36 Work Breakdown Structure (WBS): deliverable-oriented hierarchical decomposition of Work to be executed by contractor to accomplish project objectives and create required deliverables. It organizes and defines total scope of Project. Each descending level represents an increasingly detailed definition of Project Work. WBS is decomposed into Work packages.

.2 Reference Standards:

.1 Project Management Institute (PMI Standards)

.1 A Guide to the Project Management Body of Knowledge (PMBOK Guide) - Sixth Edition.

.2 Practice Standard for Scheduling - 2019.

1.3 ADMINISTRATIVE REQUIREMENTS

.1 Project Meeting:

.1 Meet with Departmental Representative within ten working days of Award of Contract date, to establish Work requirements and approach to project construction operations.

.2 Participate in regular project progress meetings with Departmental Representative specifically intended to discuss update of detailed schedule and contract changes.

.2 Scheduling:

.1 Planning: ensure that planning process is iterative and results in generally top-down processing with more detail being developed as planning progresses, and decisions concerning options and alternatives are made.

.2 Ensure project schedule efficiencies through monitoring of Project in detail to ensure integrity of Critical Path, by comparing actual completions of individual activities with their scheduled completions, and review progress of activities that has started but are not yet completed.

.3 Monitor sufficiently often so that causes of delays can immediately be identified and removed.

.3 Project monitoring and reporting:

.1 Keep team aware of changes to schedule, and possible consequences as project progresses.

.2 Use narrative reports to provide advice on seriousness of difficulties and measures to overcome them.

.3 Begin narrative reporting with statement on general status of Project followed by summarization of delays, potential problems, corrective measures and Project status criticality.

.4 Critical Path Method (CPM) Requirements:

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

.2 Revise Master Schedule and Detail Schedule deemed impractical by Departmental Representative and resubmit for approval.

.3 Change to Contract Duration:

.1 Acceptance of Master Schedule and Detail Schedule showing scheduled Contract duration shorter than specified Contract duration does not constitute change to Contract.

.2 Duration of Contract may only be changed through bilateral Agreement.

.4 Consider Master Schedule and Detail Schedule deemed practical by Departmental Representative, showing Work completed in less than specified Contract duration, to have float.

.5 First Milestone on Master Schedule and Detail Schedule will identify start Milestone with an "ES" constraint date equal to Award of Contract date.

.6 Calculate dates for completion milestones from Plan and Schedule using specified time periods for Contract.

.7 Interim Certificate with "LF" constraint equal to calculated date.

.8 Calculations on updates to be such that if early finish of Interim Certificate falls later than specified Contract duration then float calculation to reflect negative float.

.9 Delays to non-critical activities, those with float may not be basis for time extension.

.10 Do not use float suppression techniques such as software constraints, preferential sequencing, special lead/lag logic restraints, extended activity times imposed dates other than required by Contract.

.11 Allow for and show Master Plan and Detail Schedule adverse weather conditions normally anticipated.

.1 Specified Contract duration has been predicated assuming normal amount of adverse weather conditions.

.12 Provide necessary crews and manpower to meet schedule requirements for performing Work within specified Contract duration.

.1 Simultaneous use of multiple crews on multiple fronts on multiple critical paths may be required.

.13 Arrange participation on and off site of subcontractors and suppliers, as required by Departmental Representative, for purpose of network planning, scheduling, updating and progress monitoring.

.1 Approvals by Departmental Representative of original networks and revisions do not relieve Contractor from duties and responsibilities required by Contract.

.14 Ensure that it is understood that Award of Contract or time of beginning, rate of progress, Interim Certificate and Final Certificate as defined times of completion are of essence of this contract.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Submit to Departmental Representative Project Control System for planning, scheduling, monitoring and reporting of project progress.

.3 Submit Project Control System to Departmental Representative for approval.

.1 Failure to comply with each required submission, may result in progress payment being withheld.

.4 Include costs for execution, preparation and reproduction of schedule submittals in bid documents.

.5 Submit letter ensuring that schedule has been prepared in co-ordination with major sub-contractors.

.6 Refer to article "PROGRESS MONITORING AND REPORTING" of this specification Section for frequency of Project control system submittals.

.7 Submit impact analysis of schedule for changes that result in extension of contract duration.

.1 Include draft schedule update and report as outlined in article "PROGRESS MONITORING AND REPORTING".

.8 Submit Project planning, monitoring and control system data as part of initial schedule submission and monthly status reporting and as required by Departmental Representative in following form.

.1 Flash drive files in original scheduling software containing schedule and cash flow information, labelled with data date, specific update, and person responsible for update.

.2 Master Schedule Bar Chart.

.3 Construction Detail schedule Bar Chart.

.4 Listing of project activities including milestones and logical connectors, networks (sub-networks) from Project start to end. Sort activities by activity identification number and accompany with descriptions. List early and late start and finish dates together with durations, codes and float.

.5 Criticality report listing activities and milestones with up to 5 days total float used as first sort for ready identification of critical paths through entire project. List early and late starts and finishes dates, together with durations, codes and float for critical activities.

.6 Progress report in early start sequence, listing for each trade, activities due to start, or finished within 2 months from monthly update date. List activity identification number, description and duration. Provide columns for entry of actual start and finish dates, duration remaining and remarks concerning action required.

1.5 QUALITY ASSURANCE

.1 Use experienced personnel, fully qualified in planning and scheduling to provide services from start of construction to Final Certificate, including Commissioning.

1.6 WORK BREAKDOWN STRUCTURE (WBS)

.1 Prepare construction Work Breakdown Structure (WBS) within ten working days of Award of Contract date.

.1 Develop WBS through at least five levels: project, stage, element, sub-element and work package.

1.7 PROJECT MILESTONES

.1 Mandatory and recommended project milestones form targets for both Master Schedule and Detail Schedule of CPM construction network system.

.1 Recommended: interior finishing and fitting, mechanical and electrical work completed within 50 working days of Award of Contract date.

.2 Recommended: interim Certificate (substantial completion) within 55 working days of Award of Contract date.

.3 Mandatory: final Certificate completion within 60 working days of Award of Contract date.

1.8 MASTER SCHEDULE

.1 Structure and base CPM construction networks system on WBS coding in order to ensure consistency throughout Project.

.2 Prepare comprehensive construction Master Schedule (CPM logic diagram) and dependent Cash Flow Projection within ten working days of finalizing Agreement to confirm validity or alternates of identified milestones.

.1 Master Schedule will be used as baseline.

.1 Revise baseline as conditions dictate and as required by Departmental Representative.

.2 Departmental Representative as Project progresses will review and return revised baseline within five work days.

.3 Reconcile revisions to Master Schedule and Cash Flow Projections with previous baseline to provide continuous audit trail.

.4 Initial and subsequent Master Schedule will include:

.1 Flash drive containing schedule and cash flow information, clearly labelled with data date, specific update, and person responsible for update.

.2 Bar chart identifying coding, activity durations, early/late and start/finish dates, total float, completion as percentile, current status and budget amounts.

.3 Network diagram showing coding, activity sequencing (logic), total float, early/late dates, current status and durations.

.4 Actual/projected monthly cash flow: expressed monthly and shown in both graphical and numerical form.

1.9 DETAIL SCHEDULE

.1 Provide detailed project schedule (CPM logic diagram) within ten working days of Award of Contract date showing activity sequencing, interdependencies and duration estimates. Include listed activities as follows:

.1 Shop drawings.

.2 Samples.

.3 Approvals.

.4 Procurement.

.5 Construction.

.6 Installation.

.7 Site works.

.8 Testing.

.9 Commissioning and acceptance.

.2 Detail CPM schedule to cover in detail minimum period of three months beginning from Award of Contract date.

.1 Show remaining activities for CPM construction network system up to Final Certificate and develop complete detail as project progresses.

.2 Detail activities completely and comprehensively throughout duration of project.

.3 Relate Detail Schedule activities to basic activities and milestones developed and approved in Master Schedule.

.4 Clearly show sequence and interdependence of construction activities and indicate:

.1 Start and completion of all items of Work, their major components, and interim milestone completion dates.

.2 Activities for procurement, delivery, installation and completion of each major piece of equipment, materials and other supplies, including:

.1 Time for submittals, resubmittals and review.

.2 Time for fabrication and delivery of manufactured products for Work.

.3 Interdependence of procurement and construction activities.

.3 Include sufficient detail to assure adequate planning and execution of Work. Activities should generally range in duration from 3 to 15 workdays each.

.5 Provide level of detail for project activities such that sequence and interdependency of Contract tasks are demonstrated and allow co-ordination and control of project activities. Show continuous flow from left to right.

.6 Ensure activities with no float are calculated and clearly indicated on logical CPM construction network system as being, whenever possible, continuous series of activities throughout length of Project to form "Critical Path". Increased number of critical activities is seen as indication of increased risk.

.7 Insert Change Orders in appropriate and logical location of Detail Schedule. After analysis, clearly state and report to Departmental Representative for review effects created by insertion of new Change Order.

1.10 REVIEW OF THE CONSTRUCTION DETAIL SCHEDULE

.1 Allow 5 work days for review by Departmental Representative of proposed construction Detail Schedule.

.2 Upon receipt of reviewed Detail Schedule make necessary revisions and resubmit to Departmental Representative for review within 5 work days.

.3 Promptly provide additional information to validate practicability of Detail Schedule as required by Departmental Representative.

.4 Submittal of Detail Schedule indicates that it meets Contract requirements and will be executed generally in sequence.

1.11 COMPLIANCE WITH DETAIL SCHEDULE

.1 Comply with reviewed Detail Schedule.

.2 Proceed with significant changes and deviations from scheduled sequence of activities that cause delay, only after written receipt of approval by Departmental Representative.

.3 Identify activities that are behind schedule and causing delay. Provide measures to regain slippage.

.1 Corrective measures may include:

.1 Increase of personnel on site for effected activities or work package.

.2 Increase in materials and equipment.

.3 Overtime work and additional work shifts.

.4 Submit to Departmental Representative, justification, project schedule data and supporting evidence for approval of extension to Contract completion date or interim milestone date when required. Include as part of supporting evidence:

.1 Written submission of proof of delay based on revised activity logic, duration and costs, showing time impact analysis illustrating influence of each change or delay relative to approved contract schedule.

.2 Prepared schedule indicating how change will be incorporated into the overall logic diagram. Demonstrate perceived impact based on date of occurrence of change and include status of construction at that time.

.3 Other supporting evidence requested by Departmental Representative.

.4 Do not assume approval of Contract extension prior to receipt of written approval from Departmental Representative.

.5 In event of Contract extension, display in Detail Schedule that scheduled float time available for work involved has been used in full without jeopardizing earned float.

.1 Departmental Representative will determine and advise Contractor number of allowable days for extension of Contract based on project schedule updates for period in question, and other factual information.

.2 Construction delays affecting project schedule will not constitute justification for extension of contract completion date.

1.12 PROGRESS MONITORING AND REPORTING

.1 On ongoing basis, Detail Schedule on job site must show "Progress to Date". Arrange participation on and off site of subcontractors and suppliers, as, and when necessary, for purpose of network planning, scheduling, updating and progress monitoring. Inspect Work with Departmental Representative at least once monthly to establish progress on each current activity shown on applicable networks.

.2 Update and reissue project Work Breakdown Structure and relevant coding structures as project develops and changes.

.3 Perform Detail Schedule update monthly with status dated (Data Date) on last working day of month. Update to reflect activities completed to date, activities in progress, logic and duration changes.

.4 Do not automatically update actual start and finish dates by using default mechanisms found in project management software.

.5 Submit to Departmental Representative copies of updated Detail Schedule.

.6 Requirements for monthly progress monitoring and reporting are basis for progress payment request.

.7 Submit monthly written report based on Detail Schedule, showing Work to date performed, comparing Work progress to planned, and presenting current forecasts. Report must summarize progress, defining problem areas and anticipated delays with respect to Work schedule, and critical paths. Explain alternatives for possible schedule recovery to mitigate any potential delay. Include in report:

.1 Description of progress made.

.2 Pending items and status of: permits, shop drawings, change orders, possible time extensions.

.3 Status of Contract completion date and milestones.

.4 Current and anticipated problem areas, potential delays and corrective measures.

.5 Review of progress and status of Critical Path activities.

Part 2 Products

2.1 NOT USED

.1 Not used.

Part 3 Execution

3.1 NOT USED

.1 Not used.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 This section of the Specification forms part of the Contract Documents and is to be read, interpreted, and coordinated with all other parts.

.2 Section 21 05 01 Common Work Results for Mechanical

1.2 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.

1.3 SHOP DRAWINGS AND PRODUCT DATA

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

.2 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.

.3 Allow ten days for Departmental Representative's review of each submission.

.4 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.

.5 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.

.6 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.
- .5 Other pertinent data.

.7 Submissions include:

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

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

.9 Submit electronic copy of shop drawings for each requirement requested in specification Sections and as Departmental Representative may reasonably request.

.10 Submit electronic copies of product data sheets or brochures for requirements requested in specification Sections and as requested by Departmental Representative where shop drawings will not be prepared due to standardized manufacture of product.

.11 Submit electronic copies of test reports for requirements requested in specification Sections and as requested by Departmental Representative.

.1 Report signed by authorized official of testing laboratory that material, product or system identical to material, product or system to be provided has been tested in accord with specified requirements.

.2 Testing must have been within 3 years of date of contract award for project.

.12 Submit electronic copies of certificates for requirements requested in specification Sections and as requested by Departmental Representative.

.1 Statements printed on manufacturer's letterhead and signed by responsible officials of manufacturer of product, system or material attesting that product, system or material meets specification requirements.

.2 Certificates must be dated after award of project contract complete with project name.

.13 Submit electronic copies 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.

.14 Submit electronic copies of Manufacturer's Field Reports for requirements requested in specification Sections and as requested by Departmental Representative.

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

.16 Submit electronic copies of Operation and Maintenance Data for requirements requested in specification Sections and as requested by Departmental Representative.

.17 Delete information not applicable to project.

.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 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.

1.4 SAMPLES

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

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

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

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

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

.6 Make changes in samples 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.

1.5 MOCK-UPS

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

1.6 PHOTOGRAPHIC DOCUMENTATION

.1 Submit electronic copy of colour digital photography in jpg format, standard resolution minimum monthly with progress statement or more frequently 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: weekly.

.1 Upon completion of: framing and services before concealment of Work.

1.7 CERTIFICATES AND TRANSCRIPTS

.1 Immediately after award of Contract, submit Workers' Compensation Board status.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

PWGSCC Update on Asbestos Use
Effective April 1, 2016, all Public Works and Government Services Canada (PWGSC) contracts for new construction and major rehabilitation will prohibit the use of asbestos-containing materials. Further information can be found at http://www.tpsgc-pwgsc.gc.ca/comm/vedette-features/2016-04-19-00-eng.html

1.1 REFERENCES

.1 Government of Canada.

- .1 Canada Labour Code - Part II
- .2 Canada Occupational Health and Safety Regulations.

.2 National Building Code of Canada (NBC)

- .1 Part 8, Safety Measures at Construction and Demolition Sites.

.3 The Canadian Electric Code (as amended)

.4 DST Pre-Renovation Hazardous Materials Assessment Report Dated July 29, 2019

.5 Canadian Standards Association (CSA) as amended:

- .1 CSA Z797-18 Code of Practice for Access Scaffold
- .2 CSA S269.1-1975 (R2003) Falsework for Construction Purposes
- .3 CSA S350-M1980 (R2003) Code of Practice for Safety in Demolition of Structures
- .4 CSA Z1006-16 Management of Work in Confined Spaces.
- .5 CSA Z462-18 Workplace Electrical Safety Standard

.6 National Fire Code of Canada 2015 (as amended)

- .1 Part 5 – Hazardous Processes and Operations and Division B as applicable and required.

.7 American National Standards Institute (ANSI):

.8 Preliminary Hazard Assessment Appendix B

.9 ANSI A10.3, Operations – Safety Requirements for Powder-Actuated Fastening Systems.

.10 Province of British Columbia:

- .1 Workers Compensation Act Part 3-Occupational Health and Safety.
- .2 Occupational Health and Safety Regulations

1.2 RELATED SECTIONS

.1 Refer to the following current Sections as required:

- .1 Construction progress schedules: Section 013216.06
- .2 Submittals procedures: Section 013300
- .3 Construction facilities: Section 015200
- .4 Temporary barriers and enclosures: Section 015600
- .5 Structure demolition: Section 024199
- .6 Section 02 81 01 - Hazardous Materials

.7 Section 02 82 00.02 - Asbestos Remediation – Intermediate Precautions

.8 Section 02 87 13.15 - Mould Remediation – Maximum Precautions

1.3 WORKERS' COMPENSATION BOARD COVERAGE REGULATIONS

.1 Comply fully with the Workers' Compensation Act, regulations and orders made pursuant thereto, and any amendments up to the completion of the work.

.2 Maintain Workers' Compensation Board coverage during the term of the Contract, until and including the date that the Certificate of Final Completion is issued.

1.4 COMPLIANCE WITH REGULATIONS

.1 PSPC may terminate the Contract without liability to PSPC where the Contractor, in the opinion of PWGSC, refuses to comply with a requirement of the Workers' Compensation Act or the Occupational Health and Safety Regulations.

.2 It is the Contractor's responsibility to ensure that all workers are qualified, competent and certified to perform the work as required by the Workers' Compensation Act or the Occupational Health and Safety Regulations.

1.5 SUBMITTALS

.1 Submit to Departmental Representative submittals listed for review in accordance with Section 013300.

.2 Work effected by submittal shall not proceed until review is complete.

.3 Submit the following:

.1 Site Specific Health and Safety Plan.

.2 Copies of reports or directions issued by Federal and Provincial health and safety inspectors.

.3 Copies of incident and accident reports.

.4 Complete set of current Material Safety Data Sheets (MSDS), and all other documentation required by Workplace Hazardous Materials Information System (WHMIS) requirements.

.5 Emergency Procedures.

.4 The Departmental Representative will review the Contractor's Site Specific Health and Safety Plan and emergency procedures, and provide comments to the Contractor within 5 days after receipt of the plan. Revise the plan as appropriate and resubmit to Departmental Representative.

.5 Medical surveillance: where prescribed by legislation, regulation or safety program, submit certification of medical surveillance for site personnel prior to commencement of work, and submit additional certifications for any new site personnel to Departmental Representative.

.6 Submission of the Site Specific Health and Safety Plan, and any revised version, to the Departmental Representative is for information and reference purposes only. It shall not:

.1 Be construed to imply approval by the Departmental Representative.

.2 Be interpreted as a warranty of being complete, accurate and legislatively compliant.

.3 Relieve the Contractor of his legal obligations for the provision of health and safety on the project.

1.6 RESPONSIBILITY

.1 Assume responsibility as the Prime Contractor for work under this contract.

.2 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.

.3 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.

1.7 HEALTH AND SAFETY COORDINATOR

.1 The Health and Safety Coordinator:

.1 Be responsible for completing all health and safety training and ensuring that personnel that do not successfully complete the required training are not permitted to enter the site to perform work.

.2 Be responsible for implementing, revising, daily enforcing, and monitoring the Site Specific Health and Safety Plan.

.3 Be on site during execution of work.

1.8 GENERAL CONDITIONS

.1 Provide safety barricades and lights around work site as required to provide a safe working environment for workers and protection for pedestrian and vehicular traffic.

.2 Ensure that non-authorized persons are not allowed to circulate in designated construction areas of the work site.

.1 Provide appropriate means by use of barricades, fences, warning signs, traffic control personnel, and temporary lighting as required.

.2 Secure site at night time or provide security guard as deemed necessary to protect site against entry.

1.9 PROJECT/SITE CONDITIONS

.1 Work at site will involve contact with:

.1 Multi-employer work site.

.2 Federal employees.

.3 Refer to Appendix A – Preliminary Hazard Assessment

.4 Refer to Pre-Renovation Hazardous Materials Assessment DST Dated July 29, 2019 (Building Eo481 -450 Gibson Street, Tofino, B.C).

1.10 UTILITY CLEARANCES

.1 The Contractor is solely responsible for all utility detection and clearances prior to starting the work.

.2 The Contractor will not rely solely upon the Reference Drawings or other information provided for utility locations.

1.11 REGULATORY REQUIREMENTS

.1 Comply with specified codes, acts, bylaws, standards and regulations to ensure safe operations at site.

.2 In event of conflict between any provision of the above authorities, the most stringent provision will apply. Should a dispute arise in determining the most stringent requirement, the Departmental Representative will advise on the course of action to be followed.

1.12 WORK PERMITS

.1 Obtain speciality permits related to project before start of work.

1.13 FILING OF NOTICE

.1 The General Contractor is to complete and submit a Notice of Project as required by Provincial authorities.

.2 Provide copies of all notices to the Departmental Representative.

1.14 HEALTH AND SAFETY PLAN

.1 Conduct a site-specific hazard assessment based on review of Contract documents, required work, and project site. Identify any known and potential health risks and safety hazards.

.2 Prepare and comply with a site-specific project Health and Safety Plan based on hazard assessment, including, but not limited to, the following:

.1 Primary requirements:

.1 Contractor's safety policy.

.2 Identification of applicable compliance obligations.

.3 Definition of responsibilities for project safety/organization chart for project.

.4 General safety rules for project.

.5 Job-specific safe work procedures.

.6 Inspection policy and procedures.

.7 Incident reporting and investigation policy and procedures.

.8 Occupational Health and Safety Committee/Representative procedures.

.9 Occupational Health and Safety meetings.

.10 Occupational Health and Safety communications and record keeping procedures.

.2 Summary of health risks and safety hazards resulting from analysis of hazard assessment, with respect to site tasks and operations which must be performed as part of the work.

.3 List hazardous materials to be brought on site as required by work.

.4 Indicate Engineering and administrative control measures to be implemented at the site for managing identified risks and hazards.

.5 Identify personal protective equipment (PPE) to be used by workers.

.6 Identify personnel and alternates responsible for site safety and health.

.7 Identify personnel training requirements and training plan, including site orientation for new workers.

.3 Develop the plan in collaboration with all subcontractors. Ensure that work/activities of subcontractors are included in the hazard assessment and are reflected in the plan.

.4 Revise and update Health and Safety Plan as required, and re-submit to the Departmental Representative.

.5 Departmental Representative's review: the review of Site Specific Health and Safety Plan by Public Service and Procurement Canada (PSPC) shall not relieve the Contractor of responsibility for errors or omissions in final Site Specific Health and Safety Plan or of responsibility for meeting all requirements of construction and Contract documents.

1.15 EMERGENCY PROCEDURES

.1 List standard operating procedures and measures to be taken in emergency situations. Include an evacuation plan and emergency contacts (i.e. names/telephone numbers) of:

- .1 Designated personnel from own company.
- .2 Regulatory agencies applicable to work and as per legislated regulations.
- .3 Local emergency resources.
- .4 Departmental Representative.

.2 Include the following provisions in the emergency procedures:

- .1 Notify workers and the first-aid attendant, of the nature and location of the emergency.
- .2 Evacuate all workers safely.
- .3 Check and confirm the safe evacuation of all workers.
- .4 Notify the fire department or other emergency responders.
- .5 Notify adjacent workplaces or residences which may be affected if the risk extends beyond the workplace.
- .6 Notify Departmental Representative.

.3 Provide written rescue/evacuation procedures as required for, but not limited to:

- .1 Work at high angles.
- .2 Work in confined spaces or where there is a risk of entrapment.
- .3 Work with hazardous substances.
- .4 Underground work.
- .5 Work on, over, under and adjacent to water.
- .6 Workplaces where there are persons who require physical assistance to be moved.

.4 Design and mark emergency exit routes to provide quick and unimpeded exit.

1.16 HAZARDOUS PRODUCTS

.1 Comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage and disposal of hazardous materials, and regarding labelling and provision of Material Safety Data Sheets (MSDS) acceptable to the Departmental Representative and in accordance with the Canada Labour Code.

.2 Where use of hazardous and toxic products cannot be avoided:

- .1 Advise Departmental Representative beforehand of the product(s) intended for use. Submit applicable MSDS and WHMIS documents as per Section 013300.

.2 In conjunction with Departmental Representative, schedule to carry out work during "off hours" when tenants have left the building.

.3 Provide adequate means of ventilation in accordance with Section 015100.

.4 The contractor shall ensure that the product is applied as per manufacturers' recommendations.

.5 The contractor shall ensure that only pre-approved products are brought onto the work site in an adequate quantity to complete the work.

1.17 ASBESTOS HAZARD

.1 Carry out any activities involving asbestos in accordance with applicable Provincial Regulations.

.2 Removal and handling of asbestos will be performed as per Provincial and Federal Regulations.

1.18 PCB REMOVALS

.1 Mercury-containing fluorescent tubes and ballasts which contain polychlorinated biphenyls (PCBs) are classified as hazardous waste.

.2 Remove, handle, transport and dispose of as per Provincial and Federal Regulations.

1.19 REMOVAL OF LEAD- CONTAINING PAINTS

.1 All paints containing TCLP lead concentrations above 5 ppm are classified as hazardous.

.2 Carry out demolition, remediation and disposal activities involving lead-containing paints in accordance with applicable Provincial and Federal Regulations.

1.20 Silica

.1 Carry out work in accordance with Worksafe BC regulations

1.21 ELECTRICAL SAFETY REQUIREMENTS

.1 Comply with authorities and ensure that, when installing new facilities or modifying existing facilities, all electrical personnel are completely familiar with existing and new electrical circuits and equipment and their operation.

.1 Before undertaking any work, coordinate required energizing and de-energizing of new and existing circuits with Departmental Representative.

.2 Maintain electrical safety procedures and take necessary precautions to ensure safety of all personnel working under this Contract, as well as safety of other personnel on site.

1.22 ELECTRICAL LOCKOUT

.1 Develop, implement and enforce use of established procedures to provide electrical lockout and to ensure the health and safety of workers for every event where work must be done on any electrical circuit or facility.

.2 Prepare the lockout procedures in writing, listing step-by-step processes to be followed by workers, including how to prepare and issue the request/authorization form. Have procedures available for review upon request by the Departmental Representative.

.3 Keep the documents and lockout tags at the site and list in a log book for the full duration of the Contract. Upon request, make such data available for viewing by Departmental Representative or by any authorized safety representative.

1.23 OVERLOADING

.1 Ensure no part of work is subjected to a load which will endanger its safety or will cause permanent deformation.

1.24 FALSEWORK

.1 Design and construct falsework in accordance with CSA S269.1- 1975 (R2003).

1.25 SCAFFOLDING

.1 Design, construct and maintain scaffolding in a rigid, secure and safe manner, in accordance with CSA Z797-2018 and B.C. Occupational Health and Safety Regulations.

1.26 CONFINED SPACES

.1 Carry out work in confined spaces in compliance with Provincial / Territorial Regulations

1.27 POWDER-ACTUATED DEVICES

.1 Use powder-actuated devices in accordance with ANSI A10.3 only after receipt of written permission from the Departmental Representative.

1.28 FIRE SAFETY AND HOT WORK

.1 Obtain Departmental Representative's authorization before any welding, cutting or any other hot work operations can be carried out on site.

.2 Hot work includes cutting/melting with use of torch, flame heating roofing kettles, or other open flame devices and grinding with equipment which produces sparks.

1.29 FIRE SAFETY REQUIREMENTS

.1 Store oily/paint-soaked rags, waste products, empty containers and materials subject to spontaneous combustion in ULC approved, sealed containers and remove from site on a daily basis.

.2 Handle, store, use and dispose of flammable and combustible materials in accordance with the National Fire Code of Canada.

.3 Portable gas and diesel fuel tanks are not permitted on most federal work sites. Approval from the Departmental Representative is required prior to any gas or diesel tank being brought onto the work site.

1.30 FIRE PROTECTION AND ALARM SYSTEM

.1 Fire protection and alarm systems shall not be:

.1 Obstructed.

.2 Shut off.

.3 Left inactive at the end of a working day or shift.

.2 Do not use fire hydrants, standpipes and hose systems for purposes other than firefighting.

.3 Be responsible/liable for costs incurred from the fire department, the Departmental Representative and the tenants, resulting from false alarms.

1.31 UNFORESEEN HAZARDS

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

1.32 POSTED DOCUMENTS

.1 Post legible versions of the following documents on site:

.1 Site Specific Health and Safety Plan.

.2 Sequence of work.

.3 Emergency procedures.

.4 Site drawing showing project layout, locations of the first-aid station, evacuation route and marshalling station, and the emergency transportation provisions.

.5 Notice of Project.

.6 Floor plans or site plans.

.7 Notice as to where a copy of the Workers' Compensation Act and Regulations are available on the work site for review by employees and workers.

.8 Workplace Hazardous Materials Information System (WHMIS) documents.

.9 Material Safety Data Sheets (MSDS).

.10 List of names of Joint Health and Safety Committee members, or Health and Safety Representative, as applicable.

.2 Post all Material Safety Data Sheets (MSDS) on site, in a common area, visible to all workers and in locations accessible to tenants when work of this Contract includes construction activities adjacent to occupied areas.

.3 Postings should be protected from the weather, and visible from the street or the exterior of the principal construction site shelter provided for workers and equipment, or as approved by the Departmental Representative.

1.33 MEETINGS

.1 Attend health and safety pre-construction meeting and all subsequent meetings called by the Departmental Representative.

1.34 CORRECTION OF NON-COMPLIANCE

.1 Immediately address health and safety non-compliance issues identified by the Departmental Representative.

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

.3 The Departmental Representative may issue a "stop work order" if non-compliance of health and safety regulations is not corrected immediately or within posted time. The General Contractor/subcontractors will be responsible for any costs arising from such a "stop work order".

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 This section of the Specification forms part of the Contract Documents and is to be read, interpreted, and coordinated with all other parts.

1.2 REFERENCES AND CODES

.1 Perform design and Work in accordance with Codes Canada 2015, BC Building Code 2018, BC Plumbing Code 2018 including amendments up to tender closing date and other codes of provincial or local application provided that in case of conflict or discrepancy, more stringent requirements apply.

.2 Meet or exceed requirements of:

.1 Contract documents.

.2 Specified standards, codes and referenced documents.

1.3 PERMITS & INSPECTIONS

.1 Contractor shall apply and obtain a building permit and include cost of associated fee within the tender price.

.2 The Contractor shall obtain all permits and pay all fees relating to the Work to all authorities having jurisdiction unless otherwise directed by the Departmental Representative.

1.4 HAZARDOUS MATERIAL DISCOVERY

.1 Asbestos: demolition of spray or trowel-applied asbestos is hazardous to health. Stop work immediately when material resembling spray or trowel-applied asbestos is encountered during demolition work. Notify Departmental Representative. Refer to 02 82 00.02 - Asbestos Abatement - Intermediate Precautions.

.2 Mould: stop work immediately when material resembling mould is encountered during demolition work. Notify Departmental Representative. Refer to Section 02 87 13.15 - Mould Remediation - Maximum Precautions.

1.5 BUILDING SMOKING ENVIRONMENT

.1 Comply with smoking restrictions and municipal by-laws.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 This section of the Specification forms part of the Contract Documents and is to be read, interpreted, and coordinated with all other parts.

.2 Section 23 05 93 Testing, Adjusting, and Balancing for HVAC.

1.2 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 will order 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.

1.3 INDEPENDENT INSPECTION AGENCIES

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

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

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

.4 If defects are revealed during inspection and/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.

1.4 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.

1.5 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 orderly sequence to not cause delays in Work.

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

1.6 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 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 will deduct from Contract Price difference in value between Work performed and that called for by Contract Documents, amount of which will be determined by Departmental Representative.

1.7 REPORTS

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

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

1.8 TESTS AND MIX DESIGNS

.1 Furnish test results and mix designs as requested.

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

1.9 MOCK-UPS

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

.2 Construct in locations as specified in specific Section.

.3 Prepare mock-ups for Departmental Representative review with reasonable promptness and in orderly sequence, to not cause delays in Work.

.4 Failure to prepare mock-ups in ample time is not considered sufficient reason for extension of Contract Time and no claim for extension by reason of such default will be allowed.

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

.6 Specification section identifies whether mock-up may remain as part of Work or if it is to be removed and when.

1.10 MILL TESTS

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

1.11 EQUIPMENT AND SYSTEMS

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

.2 Refer to Section 23 05 93 Testing, Adjusting, and Balancing for HVAC for definitive requirements.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 This section of the Specification forms part of the Contract Documents and is to be read, interpreted, and coordinated with all other parts.

.2 Section 21 05 01 Common Work Results for Mechanical.

1.2 REFERENCES

.1 U.S. Environmental Protection Agency (EPA) / Office of Water

.1 EPA 832R92005, Storm Water Management for Construction Activities: Developing Pollution Prevention Plans and Best Management Practices.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

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 TEMPORARY HEATING AND VENTILATION

.1 Provide temporary heating required during 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.

.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 degrees 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, not to be used when available. Be responsible for damage to heating system if use is permitted.

.7 Maintain strict supervision of operation of temporary heating and ventilating equipment to:

.1 Conform to 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.

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

1.6 TEMPORARY COMMUNICATION FACILITIES

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

1.7 FIRE PROTECTION

.1 Provide and maintain temporary fire protection equipment during performance of Work required by insurance companies having jurisdiction 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 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 This section of the Specification forms part of the Contract Documents and is to be read, interpreted, and coordinated with all other parts.

1.2 REFERENCES

.1 Canadian General Standards Board (CGSB)

- .1 CAN/CGSB 1.189-00, Exterior Alkyd Primer for Wood.
- .2 CGSB 1.59-97, Alkyd Exterior Gloss Enamel.

.2 Canadian Standards Association (CSA International)

- .1 CSA-A23.1/A23.2-19, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.
- .2 CSA-0121-17, Douglas Fir Plywood.
- .3 CAN/CSA-S269.2-16, Access Scaffolding for Construction Purposes.
- .4 CAN/CSA-Z321-96(R2006), Signs and Symbols for the Occupational Environment.

.3 Public Works Government Services Canada (PWGSC) Standard Acquisition Clauses and Conditions (SACC)-ID: R0202D, Title: General Conditions 'C', In Effect as of: May 14, 2004.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

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 CAN/CSA-S269.2.

.2 Provide and maintain scaffolding, ramps, ladders, platforms, and temporary stairs as needed.

1.6 HOISTING

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

.2 Hoists to be operated by qualified operator.

1.7 SITE STORAGE/LOADING

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

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

1.8 CONSTRUCTION PARKING

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

.2 Provide and maintain adequate access to project site.

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

1.9 SECURITY

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

1.10 OFFICES

.1 Provide office heated up to 22 degrees C, lighted 750 lx and ventilated, of sufficient size to accommodate site meetings and furnished with drawing laydown table.

.2 Provide marked and fully stocked first-aid case in a readily available location.

.3 Subcontractors to provide their own offices as necessary. Direct location of these offices.

1.11 EQUIPMENT, TOOL AND MATERIALS STORAGE

.1 Provide and maintain, in 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 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 precautions as required by local health authorities. Keep area and premises in sanitary condition.

1.13 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.

.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 road as necessary.

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

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

.10 Location, grade, width, and alignment of construction road: subject to approval by Departmental Representative.

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

.12 Provide snow removal during period of Work.

.13 Remove, upon completion of work, access road designated by Departmental Representative.

1.14 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.

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

.4 Stack stored new or salvaged material not in construction facilities.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 This section of the Specification forms part of the Contract Documents and is to be read, interpreted, and coordinated with all other parts.

1.2 REFERENCES

.1 Canadian General Standards Board (CGSB)

.1 CGSB 1.59-97, Alkyd Exterior Gloss Enamel.

.2 CAN/CGSB 1.189-00, Exterior Alkyd Primer for Wood.

.2 Canadian Standards Association (CSA International)

.1 CSA-O121-17, Douglas Fir Plywood.

.3 Public Works Government Services Canada (PWGSC) Standard Acquisition Clauses and Conditions (SACC)-ID: R0202D, Title: General Conditions 'C', In Effect as Of: May 14, 2004.

1.3 INSTALLATION AND REMOVAL

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

.2 Remove from site all such work after use.

1.4 GUARD RAILS AND BARRICADES

.1 Provide secure, rigid guard rails and barricades around deep excavations, open shafts, open stair wells, open edges of floors and roofs, and where shown.

.2 Provide as required by governing authorities and as indicated.

1.5 WEATHER ENCLOSURES

.1 Provide weather tight closures to unfinished door and window openings, tops of shafts and other openings in floors, exterior walls and roofs.

.2 Close off floor areas where walls are not finished; seal off other openings; enclose building interior work for temporary heat.

.3 Design enclosures to withstand wind pressure.

1.6 DUST TIGHT SCREENS

.1 Provide dust tight screens or partitions to localize dust generating activities, and for protection of workers, finished areas of Work and public.

.2 Maintain and relocate protection until such work is complete.

1.7 ACCESS TO SITE

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

1.8 PUBLIC TRAFFIC FLOW

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

1.9 FIRE ROUTES

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

1.10 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.

1.11 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 3 locations and installation schedule days prior to installation.

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

1.12 WASTE MANAGEMENT AND DISPOSAL

.1 Separate waste materials for reuse or recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management And Disposal.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 This section of the Specification forms part of the Contract Documents and is to be read, interpreted, and coordinated with all other parts.

.2 Section 21 05 01 Common Work Results for Mechanical.

1.2 REFERENCES

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

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

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

.4 Cost for such testing will be born by Departmental Representative in event of conformance with Contract Documents or by Contractor in event of non-conformance.

1.3 QUALITY

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

.2 Procurement policy is to acquire, in cost effective manner, items containing highest percentage of recycled and recovered materials practicable consistent with maintaining satisfactory levels of competition. Make reasonable efforts to use recycled and recovered materials and in otherwise utilizing recycled and recovered materials in execution of work.

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

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

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

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

1.4 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 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.

.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.

1.5 TRANSPORTATION

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

.2 Transportation cost of products supplied by Departmental Representative will be paid for by Departmental Representative. Unload, handle and store such products.

1.6 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 will establish course of action.

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

1.7 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.

1.8 CO-ORDINATION

.1 Ensure co-operation of workers in laying out Work. Maintain efficient and continuous supervision.

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

1.9 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.

1.10 REMEDIAL WORK

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

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

1.11 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.

1.12 FASTENINGS

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

.2 Prevent electrolytic action between dissimilar metals and materials.

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

.4 Space anchors within individual load limit or shear capacity and ensure they provide positive permanent anchorage. Wood, 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.

1.13 FASTENINGS - EQUIPMENT

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

.2 Use heavy hexagon heads, semi-finished unless otherwise specified. Use No. 304 stainless steel for exterior areas.

.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.

1.14 PROTECTION OF WORK IN PROGRESS

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

1.15 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 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 OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 This section of the Specification forms part of the Contract Documents and is to be read, interpreted, and coordinated with all other parts.

1.2 REFERENCES

.1 Identification of existing survey control points and property limits.

1.3 EXISTING SERVICES

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

.2 Remove abandoned service lines within 2m of structures. Cap or otherwise seal lines at cut-off points as directed by Departmental Representative.

1.4 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.

1.5 RECORDS

.1 Record locations of maintained, re-routed and abandoned service lines.

1.6 ACTION AND INFORMATIONAL SUBMITTALS

.1 On request of Departmental Representative, submit documentation to verify accuracy of field engineering work.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 This section of the Specification forms part of the Contract Documents and is to be read, interpreted, and coordinated with all other parts.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submittals: in accordance with Section 01 33 00 - Submittal Procedures.

.2 Submit written request in advance of cutting or alteration which affects:

- .1 Structural integrity of elements of project.
- .2 Integrity of weather-exposed or moisture-resistant elements.
- .3 Efficiency, maintenance, or safety of operational elements.
- .4 Visual qualities of sight-exposed elements.

.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 Date and time work will be executed.

1.3 MATERIALS

.1 Required for original installation.

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

1.4 PREPARATION

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

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

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

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

.5 Provide protection from elements for areas which are to be exposed by uncovering work.

1.5 EXECUTION

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

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

.3 Uncover Work to install ill-timed Work.

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

.5 Remove samples of installed Work for testing.

.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 weather-exposed and 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 Fit Work airtight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.

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

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

1.6 WASTE MANAGEMENT AND DISPOSAL

.1 Separate waste materials for reuse or recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management And Disposal.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 This section of the Specification forms part of the Contract Documents and is to be read, interpreted, and coordinated with all other parts.

.2 Section 23 01 31 Air Duct Cleaning – HVAC Systems.

1.2 REFERENCES

.1 Public Works Government Services Canada (PWGSC) Standard Acquisition Clauses and Conditions (SACC)-ID: R0202D, Title: General Conditions "C", In Effect as Of: May 14, 2004.

1.3 PROJECT CLEANLINESS

.1 Maintain Work in tidy condition, free from accumulation of waste products and debris, other than that caused by other Contractors (as applicable).

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

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

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

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

.6 Provide and use marked separate bins for recycling. Refer to Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

.7 Dispose of waste materials and debris off site at transfer station/disposal site.

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

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

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

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

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

1.4 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 other Contractors (as applicable).

.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, unless approved by Departmental Representative.

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

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

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

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

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

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

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

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

.14 Remove dirt and other disfiguration from exterior surfaces.

.15 Clean and sweep roofs, gutters, areaways, and sunken wells.

.16 Sweep and wash clean paved areas.

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

.18 Clean roofs, downspouts, and drainage systems affected by the Work.

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

.20 Remove snow and ice from access to building.

1.5 WASTE MANAGEMENT AND DISPOSAL

.1 Separate waste materials for recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management And Disposal.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 WASTE MANAGEMENT GOALS

.1 Prior to start of Work conduct meeting with Departmental Representative to review and discuss PWGSC's Waste Management Plan and Goals.

.2 PWGSC's Waste Management Goal 75 percent of total Project Waste to be diverted from landfill sites. Provide Departmental Representative documentation certifying that waste management, recycling, reuse of recyclable and reusable materials have been extensively practiced.

.3 Accomplish maximum control of solid construction waste.

.4 Preserve environment and prevent pollution and environment damage.

1.2 RELATED REQUIREMENTS

.1 This section of the Specification forms part of the Contract Documents and is to be read, interpreted, and coordinated with all other parts.

1.3 DEFINITIONS

.1 Class III: non-hazardous waste - construction renovation and demolition waste.

.2 Cost/Revenue Analysis Workplan (CRAW): based on information from WRW, and intended as financial tracking tool for determining economic status of waste management practices.

.3 Demolition Waste Audit (DWA): relates to actual waste generated from project.

.4 Inert Fill: inert waste - exclusively asphalt and concrete.

.5 Materials Source Separation Program (MSSP): consists of series of ongoing activities to separate reusable and recyclable waste material into material categories from other types of waste at point of generation.

.6 Recyclable: ability of product or material to be recovered at end of its life cycle and re-manufactured into new product for reuse.

.7 Recycle: process by which waste and recyclable materials are transformed or collected for purpose of being transferred into new products.

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

.9 Reuse: repeated use of product in same form but not necessarily for same purpose. Reuse includes:

.1 Salvaging reusable materials from re-modelling 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.

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

.11 Separate Condition: refers to waste sorted into individual types.

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

.13 Waste Audit (WA): detailed inventory of materials in building. Involves quantifying by volume/weight amounts of materials and wastes generated during construction, demolition, deconstruction, or renovation project. Indicates quantities of reuse, recycling and landfill. Refer to Schedule A.

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

.15 Waste Reduction Workplan (WRW): written report which addresses opportunities for reduction, reuse, or recycling of materials. Refer to Schedule B. WRW is based on information acquired from WA (Schedule A).

1.4 DOCUMENTS

.1 Maintain at job site, one copy of following documents:

- .1 Waste Audit.
- .2 Waste Reduction Workplan.
- .3 Material Source Separation Plan.
- .4 Schedules A, B, C, D, and E completed for project.

1.5 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Prepare and submit following prior to project start-up:

- .1 Submit 2 copies of completed Waste Audit (WA): Schedule A.
- .2 Submit 2 copies of completed Waste Reduction Workplan (WRW): Schedule B.
- .3 Submit 2 copies of completed Demolition Waste Audit (DWA): Schedule C.
- .4 Submit 2 copies of Cost/Revenue Analysis Workplan (CRAW): Schedule D.
- .5 Submit 2 copies of Materials Source Separation Program (MSSP) description.

.3 Submit before final payment summary of waste materials salvaged for reuse, recycling or disposal by project using deconstruction/disassembly material audit form.

- .1 Failure to submit could result in hold back of final payment.
- .2 Provide receipts, scale tickets, waybills, and show quantities and types of materials reused, recycled, co-mingled and separated off-site or disposed of.
- .3 For each material reused, sold or recycled from project, include amount in tonnes and the destination.
- .4 For each material land filled or incinerated from project, include amount in tonnes of material and identity of landfill, incinerator or transfer station.

1.6 WASTE AUDIT (WA)

.1 Conduct WA prior to project start-up.

.2 Prepare WA: Schedule A.

.3 Record, on WA - Schedule A, extent to which materials or products used consist of recycled or reused materials or products.

1.7 WASTE REDUCTION WORKPLAN (WRW)

.1 Prepare WRW prior to project start-up.

.2 WRW should include but not limited to:

- .1 Destination of materials listed.
- .2 Deconstruction/disassembly techniques and sequencing.
- .3 Schedule for deconstruction/disassembly.
- .4 Location.
- .5 Security.
- .6 Protection.
- .7 Clear labelling of storage areas.
- .8 Details on materials handling and removal procedures.
- .9 Quantities for materials to be salvaged for reuse or recycled and materials sent to landfill.

.3 Structure WRW to prioritize actions and follow 3R's hierarchy, with Reduction as first priority, followed by Reuse, then Recycle.

.4 Describe management of waste.

.5 Identify opportunities for reduction, reuse, and recycling of materials. Based on information acquired from WA.

.6 Post WRW or summary where workers at site are able to review content.

.7 Set realistic goals for waste reduction, recognize existing barriers and develop strategies to overcome these barriers.

.8 Monitor and report on waste reduction by documenting total volume and cost of actual waste removed from project.

1.8 DEMOLITION WASTE AUDIT (DWA)

.1 Prepare DWA prior to project start-up.

.2 Complete DWA: Schedule C.

.3 Provide inventory of quantities of materials to be salvaged for reuse, recycling, or disposal.

1.9 COST/REVENUE ANALYSIS WORKPLAN (CRAW)

.1 Prepare CRAW: Schedule D.

1.10 MATERIALS SOURCE SEPARATION PROGRAM (MSSP)

.1 Prepare MSSP and have ready for use prior to project start-up.

.2 Implement MSSP for waste generated on project in compliance with approved methods and as reviewed by Departmental Representative.

.3 Provide on-site facilities for collection, handling, and storage of anticipated quantities of reusable and recyclable materials.

.4 Provide containers to deposit reusable and recyclable materials.

.5 Locate containers in locations, to facilitate deposit of materials without hindering daily operations.

.6 Locate separated materials in areas which minimize material damage.

.7 Collect, handle, store on-site, and transport off-site, salvaged materials in separate condition.

.1 Transport to approved and authorized recycling facility.

.8 Collect, handle, store on-site, and transport off-site, salvaged materials in combined condition.

.1 Ship materials to site operating under Certificate of Approval.

.2 Materials must be immediately separated into required categories for reuse or recycling.

1.11 WASTE PROCESSING SITES

.1 Province of: British Columbia.

.1 Name: West Coast Landfill.

.2 Telephone: 250-726-2727.

1.12 STORAGE, HANDLING AND PROTECTION

.1 Store, materials to be reused, recycled and salvaged in locations as directed by Departmental Representative.

.2 Unless specified otherwise, materials for removal do not become Contractor's property.

.3 Separate non-salvageable materials from salvaged items. Transport and deliver non-salvageable items to licensed disposal facility.

.4 Protect surface drainage, mechanical and electrical from damage and blockage.

.5 Separate and store materials produced during dismantling of structures in designated areas.

.6 Prevent contamination of materials to be salvaged and recycled and handle materials in accordance with requirements for acceptance by designated facilities.

.1 On-site source separation is recommended.

.2 Remove co-mingled materials to off-site processing facility for separation.

.3 Provide waybills for separated materials.

1.13 DISPOSAL OF WASTES

.1 Do not bury rubbish or waste materials.

.2 Do not dispose of waste, volatile materials, mineral spirits, oil, or paint thinner into waterways, storm, or sanitary sewers.

.3 Keep records of construction waste including:

.1 Number and size of bins.

.2 Waste type of each bin.

.3 Total tonnage generated.

.4 Tonnage reused or recycled.

.5 Reused or recycled waste destination.

.4 Remove materials from deconstruction as deconstruction/disassembly Work progresses.

.5 Prepare project summary to verify destination and quantities on a material-by-material basis as identified in pre-demolition material audit.

1.14 USE OF SITE AND FACILITIES

.1 Execute work with least possible interference or disturbance to normal use of premises.

.2 Maintain security measures established by existing facility.

1.15 SCHEDULING

.1 Co-ordinate Work with other activities at site to ensure timely and orderly progress of Work.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 SELECTIVE DEMOLITION

.1 Reuse of Building Elements: this project has been designed to result in end of project rates for reuse of building elements as follows: do not demolish building elements beyond what is indicated on Drawings without approval by Departmental Representative's.

.1 Building Structure and Shell: extent as shown on plans.

.2 Interior Non-Shell Elements: extent as shown on plans.

3.2 APPLICATION

.1 Do Work in compliance with WRW.

.2 Handle waste materials not reused, salvaged, or recycled in accordance with appropriate regulations and codes.

3.3 CLEANING

.1 Remove tools and waste materials on completion of Work, and leave work area in clean and orderly condition.

.2 Clean-up work area as work progresses.

.3 Source separate materials to be reused/recycled into specified sort areas.

3.4 DIVERSION OF MATERIALS

.1 From following list, separate materials from general waste stream and stockpile in separate piles or containers, as reviewed by Departmental Representative, and consistent with applicable fire regulations.

.1 Mark containers or stockpile areas.

.2 Provide instruction on disposal practices.

.2 On-site sale of salvaged, recovered, reusable, or recyclable materials is not permitted.

.3 Demolition Waste:

Material Type	Recommended Diversion %	Actual Diversion %
Acoustic Tile	50	_____
Acoustical Insulation	100	_____
Carpet	100	_____
De-mountable Partitions	80	_____
Doors and Frames	100	_____
Electrical Equipment	80	_____
Furnishings	80	_____
Marble Base	100	_____
Mechanical Equipment	100	_____
Metals	100	_____
Rubble	100	_____
Wood (uncontaminated)	100	_____

.4 Construction Waste:

Material Type	Recommended Diversion %	Actual Diversion %
Cardboard	100	_____
Plastic Packaging	100	_____
Rubble	100	_____
Steel	100	_____
Wood (uncontaminated)	100	_____

3.5 WASTE AUDIT (WA)

.1 Schedule A - Waste Audit (WA):

(1) Material Category	(2) Material Quantity Unit	(3) Estimated Waste %	(4) Total Quantity of Waste (unit)	(5) Generation Point	(6) % Recycled	(7) % Reused
Wood and Plastics Material Description						
Off-cuts						
Warped Pallet Forms						
Plastic Packaging						
Cardboard Packaging						
Other						
Doors and Windows Material Description						

Painted Frames						
Glass						
Wood						
Metal						
Other						

3.6 WASTE REDUCTION WORKPLAN (WRW)

.1 Schedule B:

(1) Material Category	(2) Person(s) Respon-sible	(3) Total Quantity of Waste (unit)	(4) Reused Amount (units) Projected	Actual	(5) Recycled Amount (unit) Projected	Actual	(6) Material(s) Destina-tion
Wood and Plastics Material Description							
Chutes							
Warped Pallet Forms							
Plastic Packag ing							
Card-board Packag ing							
Other							
Doors and Windows Material Description							
Painted Frames							
Glass							
Wood							
Metal							
Other							

3.7 DEMOLITION WASTE AUDIT (DWA)

.1 Schedule C - Demolition Waste Audit (DWA):

(1) Material Description	(2) Quantity	(3) Unit	(4) Total	(5) Volume (cum)	(6) Weight (cum)	(7) Remarks and Assumptions
Wood						
Wood Stud						
Plywood						
Baseboard-						

Wood						
Door Trim - Wood						
Cabinet						
Doors and Windows						
Panel Regular						
Slab Regular						
Wood Laminate						
Byfold - Closet						
Glazing						

3.8 COST/REVENUE ANALYSIS WORKPLAN (CRAW)

.1 Schedule D - Cost/Revenue Analysis Workplan (CRAW):

(1) Material Description	(2) Total Quantity (unit)	(3) Volume (cum)	(4) Weight (cum)	(5) Disposal Cost/Credit $(+/-)	(6) Category Sub-Total $(+/-)
Wood					
Wood Stud					
Plywood					
Baseboard - Wood					
Door Trim - Wood					
Cabinet					$
Doors and Windows					
Panel Regular					
Slab Regular					
Wood Laminate					
Byfold - Closet					
Glazing					$
		(7) Cost (-) / Revenue (+)			$

3.9 CANADIAN GOVERNMENTAL DEPARTMENTS CHIEF RESPONSIBILITY FOR THE ENVIRONMENT

.1 Schedule E - Government Chief Responsibility for the Environment:

Province	Address	General Inquires	Fax
British Columbia	Ministry of Environment Lands and Parks 810 Blanshard Street, 4 th Floor Victoria BC V8V 1X4	604-387-1161	604-356-6464

	Waste Reduction Commission Soils and Hazardous Waste 770 South Pacific Blvd, Suite 303 Vancouver BC V6B 5E7	604-660-9550	604-660-9596

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 This section of the Specification forms part of the Contract Documents and is to be read, interpreted, and coordinated with all other parts.

.2 Section 21 05 01 Common Work Results for Mechanical.

1.2 ADMINISTRATIVE REQUIREMENTS

.1 Acceptance of Work Procedures:

.1 Contractor's Inspection: Contractor: conduct 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 submit verification that corrections have been made.

.2 Request Departmental Representative inspection.

.2 Departmental Representative Inspection:

.1 Departmental Representative and Contractor to inspect Work and identify defects and deficiencies.

.2 Contractor to correct Work as directed.

.3 Completion Tasks: submit written certificates in English that tasks have been performed as follows:

.1 Work: completed and inspected for compliance with Contract Documents.

.2 Defects: corrected and deficiencies completed.

.3 Equipment and systems: tested, adjusted, and balanced and fully operational.

.4 Certificates required by Utility companies: submitted.

.5 Operation of systems: demonstrated to Departmental Representative.

.6 Commissioning of mechanical systems: completed in accordance with 01 91 13 - General Commissioning (Cx) Requirements and copies of final Commissioning Report submitted to Departmental Representative.

.7 Work: complete and ready for final inspection.

.4 Final Inspection:

.1 When completion tasks are done, request final inspection of Work by Departmental Representative, and Contractor.

.2 When Work incomplete according to Departmental Representative, complete outstanding items and request re-inspection.

1.3 FINAL CLEANING

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

.1 Remove surplus materials, excess materials, rubbish, tools and equipment.

.2 Waste Management: separate waste materials for reuse or recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 This section of the Specification forms part of the Contract Documents and is to be read, interpreted, and coordinated with all other parts.

.2 Section 21 05 01 Common Work Results for Mechanical.

1.2 ADMINISTRATIVE REQUIREMENTS

.1 Pre-warranty Meeting:

.1 Convene meeting one week prior to contract completion with contractor's representative and Departmental Representative, in accordance with Section 01 31 19 - Project Meetings to:

.1 Verify Project requirements.

.2 Review warranty requirements and manufacturer's installation instructions.

.2 Departmental Representative to establish communication procedures for:

.1 Notifying construction warranty defects.

.2 Determine priorities for type of defects.

.3 Determine reasonable response time.

.3 Contact information for bonded and licensed company for warranty work action: provide name, telephone number and address of company authorized for construction warranty work action.

.4 Ensure contact is located within local service area of warranted construction, is continuously available, and is responsive to inquiries for warranty work action.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

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

.3 Provide spare parts, maintenance materials and special tools of same quality and manufacture as products provided in Work.

.4 Provide evidence, if requested, for type, source and quality of products supplied.

1.4 FORMAT

.1 Organize data as instructional manual.

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

.3 When multiple binders are used correlate data into related consistent groupings.

.1 Identify contents of each binder on spine.

.4 Cover: 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.

.1 Bind in with text; fold larger drawings to size of text pages.

.9 Provide 1:1 scaled CAD files in dwg and PDF formats on flash drive.

1.5 CONTENTS - PROJECT RECORD DOCUMENTS

.1 Table of Contents for Each Volume: 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, including local source of supplies and replacement parts.

.3 Product Data: mark each sheet to 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.

.1 Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions specified in Section 01 45 00 - Quality Control.

.6 Training: refer to Section 01 79 00 - Demonstration and Training.

1.6 AS -BUILT DOCUMENTS AND SAMPLES

.1 Maintain at site for Departmental Representative one record copy of:

.1 Contract Drawings.

.2 Specifications.

.3 Addenda.

.4 Change Orders and other modifications to Contract.

.5 Reviewed shop drawings, product data, and samples.

.6 Field test records.

.7 Inspection certificates.

.8 Manufacturer's certificates.

.2 Store record documents and samples in field office apart from documents used for construction.

.1 Provide files, racks, and secure storage.

.3 Label record documents and file in accordance with Section number listings in List of Contents of this Project Manual.

.1 Label each document "PROJECT RECORD" in neat, large, printed letters.

.4 Maintain record documents in clean, dry and legible condition.

.1 Do not use record documents for construction purposes.

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

1.7 RECORDING INFORMATION ON PROJECT RECORD DOCUMENTS

.1 Record information on set of black line opaque drawings, provided by Departmental Representative.

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

.3 Record information concurrently with construction progress.

.1 Do not conceal Work until required information is recorded.

.4 Contract Drawings and shop drawings: mark each item to record actual construction, including:

.1 Measured depths of elements of foundation in relation to finish first floor datum.

.2 Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.

.3 Measured locations of internal utilities and appurtenances, referenced to visible and accessible features of construction.

.4 Field changes of dimension and detail.

.5 Changes made by change orders.

.6 Details not on original Contract Drawings.

.7 References to related shop drawings and modifications.

.5 Specifications: mark each item to record actual construction, including:

.1 Manufacturer, trade name, and catalogue number of each product actually installed, particularly optional items and substitute items.

.2 Changes made by Addenda and change orders.

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

.7 Provide digital photos, if requested, for site records.

1.8 FINAL SURVEY

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

1.9 EQUIPMENT AND SYSTEMS

.1 For each item of equipment and each system include description of unit or system, and component parts.

.1 Give function, normal operation characteristics and limiting conditions.

.2 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.

.1 Include regulation, control, stopping, shut-down, and emergency instructions.

.2 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.

.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 co-ordination 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 - Quality Control 01 91 13 - General Commissioning (Cx) Requirements.

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.

.1 Provide information for re-ordering custom manufactured products.

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

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

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

1.11 MAINTENANCE MATERIALS

.1 Spare Parts:

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

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

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

.4 Receive and catalogue items.

.1 Submit inventory listing to Departmental Representative.

.2 Include approved listings in Maintenance Manual.

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

.2 Extra Stock Materials:

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

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

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

.4 Receive and catalogue items.

.1 Submit inventory listing to Departmental Representative.

.2 Include approved listings in Maintenance Manual.

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

.3 Special Tools:

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

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

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

.4 Receive and catalogue items.

.1 Submit inventory listing to Departmental Representative.

.2 Include approved listings in Maintenance Manual.

1.12 DELIVERY, STORAGE AND HANDLING

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

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

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

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

.5 Remove and replace damaged products at own expense and for review by Departmental Representative.

1.13 WARRANTIES AND BONDS

.1 Develop warranty management plan to contain information relevant to Warranties.

.2 Submit warranty management plan, 30 days before planned pre-warranty conference, to Departmental Representative approval.

.3 Warranty management plan to include required actions and documents to assure that Departmental Representative receives warranties to which it is entitled.

.4 Provide plan in narrative form and contain sufficient detail to make it suitable for use by future maintenance and repair personnel.

.5 Submit, warranty information made available during construction phase, to Departmental Representative for approval prior to each monthly pay estimate.

.6 Assemble approved information in binder, submit upon acceptance of work and organize binder as follows:

.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 applicable item of work.

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

.5 Co-execute submittals when required.

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

.7 Except for items put into use with Departmental Representative's permission, leave date of beginning of time of warranty until Date of Substantial Performance is determined.

.8 Conduct joint 4 month and 9 month warranty inspection, measured from time of acceptance, by Departmental Representative.

.9 Include information contained in warranty management plan as follows:

.1 Roles and responsibilities of personnel associated with warranty process, including points of contact and telephone numbers within the organizations of Contractors, subcontractors, manufacturers or suppliers involved.

.2 Listing and status of delivery of Certificates of Warranty for extended warranty items, to include roofs, HVAC balancing, motors, commissioned systems.

.3 Provide list for each warranted equipment, item, feature of construction or system indicating:

.1 Name of item.

.2 Model and serial numbers.

.3 Location where installed.

.4 Name and phone numbers of manufacturers or suppliers.

.5 Names, addresses and telephone numbers of sources of spare parts.

.6 Warranties and terms of warranty: include one-year overall warranty of construction. Indicate items that have extended warranties and show separate warranty expiration dates.

.7 Cross-reference to warranty certificates as applicable.

.8 Starting point and duration of warranty period.

.9 Summary of maintenance procedures required to continue warranty in force.

.10 Cross-Reference to specific pertinent Operation and Maintenance manuals.

.11 Organization, names and phone numbers of persons to call for warranty service.

.12 Typical response time and repair time expected for various warranted equipment.

.4 Contractor's plans for attendance at 4 and 9 month post-construction warranty inspections.

.5 Procedure and status of tagging of equipment covered by extended warranties.

.6 Post copies of instructions near selected pieces of equipment where operation is critical for warranty and/or safety reasons.

.10 Respond in timely manner to oral or written notification of required construction warranty repair work.

.11 Written verification to follow oral instructions.

.1 Failure to respond will be cause for the Departmental Representative to proceed with action against Contractor.

1.14 WARRANTY TAGS

.1 Tag, at time of installation, each warranted item. Provide durable, oil and water resistant tag approved by Departmental Representative.

.2 Attach tags with copper wire and spray with waterproof silicone coating.

.3 Leave date of acceptance until project is accepted for occupancy.

.4 Indicate following information on tag:

.1 Type of product/material.

.2 Model number.

.3 Serial number.

.4 Contract number.

.5 Warranty period.

.6 Inspector's signature.

.7 Construction Contractor.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 This section of the Specification forms part of the Contract Documents and is to be read, interpreted, and coordinated with all other parts.

.2 Section 21 05 01 Common Work Results for Mechanical.

1.2 ADMINISTRATIVE REQUIREMENTS

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

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

.3 Preparation:

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

.2 Verify designated personnel are present.

.3 Ensure equipment has been inspected and put into operation in accordance with Section 23 05 93 Testing, Adjusting, and Balancing for HVAC and Section 23 08 00 Commissioning of Mechanical Systems.

.4 Ensure testing, adjusting, and balancing has been performed in accordance with Section 01 91 13 - General Commissioning (Cx) Requirements and equipment and systems are fully operational.

.4 Demonstration and Instructions:

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

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

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

.4 Prepare and insert additional data in operations and maintenance manuals when needed during instructions.

.5 Time Allocated for Instructions: ensure amount of time required for instruction of each item of equipment or system as follows:

.1 Ventilation System: one hour of instruction.

.2 Plumbing System: one half hour of instruction.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Submit schedule of time and date for demonstration of each item of equipment and each system two weeks prior to designated dates, for Departmental Representative's approval.

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

.4 Give time and date of each demonstration, with list of persons present.

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

1.4 QUALITY ASSURANCE

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

.1 Instruct Departmental Representative 's personnel.

.2 Provide written report that demonstration and instructions have been completed.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section Includes:

.1 General requirements relating to commissioning of project's components and systems, specifying general requirements to PV of components, equipment, sub-systems, systems, and integrated systems.

.2 Related Requirements

.1 This section of the Specification forms part of the Contract Documents and is to be read, interpreted, and coordinated with all other parts.

.2 Section 23 08 00 Commissioning of Mechanical Systems.

.3 Acronyms:

.1 AFD - Alternate Forms of Delivery, service provider.

.2 BMM - Building Management Manual.

.3 Cx - Commissioning.

.4 EMCS - Energy Monitoring and Control Systems.

.5 O M - Operation and Maintenance.

.6 PI - Product Information.

.7 PV - Performance Verification.

.8 TAB - Testing, Adjusting and Balancing.

1.2 GENERAL

.1 Cx is a planned program of tests, procedures and checks carried out systematically on systems and integrated systems of the finished Project. Cx is performed after systems and integrated systems are completely installed, functional and Contractor's Performance Verification responsibilities have been completed and approved. Objectives:

.1 Verify installed equipment, systems and integrated systems operate in accordance with contract documents and design criteria and intent.

.2 Ensure appropriate documentation is compiled into the BMM.

.3 Effectively train O M staff.

.2 Contractor assists in Cx process, operating equipment and systems, troubleshooting and making adjustments as required.

.1 Systems to be operated at full capacity under various modes to determine if they function correctly and consistently at peak efficiency. Systems to be interactively with each other as intended in accordance with Contract Documents and design criteria.

.2 During these checks, adjustments to be made to enhance performance to meet environmental or user requirements.

.3 Design Criteria: as per client's requirements or determined by designer. To meet Project functional and operational requirements.

.4 AFD managed projects the term Departmental Representative in Cx specifications to be interpreted as AFD Service Provider.

1.3 COMMISSIONING OVERVIEW

.1 Section 01 91 31 - Commissioning (Cx) Plan.

.2 For Cx responsibilities refer to Section 01 91 31 - Commissioning (Cx) Plan.

.3 Cx to be a line item of Contractor's cost breakdown.

.4 Cx activities supplement field quality and testing procedures described in relevant technical sections.

.5 Cx is conducted in concert with activities performed during stage of project delivery. Cx identifies issues in Planning and Design stages which are addressed during Construction and Cx stages to ensure the built facility and systems are constructed and proven to operate satisfactorily under weather, environmental and occupancy conditions to meet functional and operational requirements. Cx activities includes transfer of critical knowledge to facility operational personnel.

.6 Departmental Representative DCC Representative will issue Interim Acceptance Certificate when:

.1 Completed Cx documentation has been received, reviewed for suitability and approved by Departmental Representative.

.2 Equipment, components and systems have been commissioned.

.3 O M training has been completed.

1.4 NON-CONFORMANCE TO PERFORMANCE VERIFICATION REQUIREMENTS

.1 Should equipment, system components, and associated controls be incorrectly installed or malfunction during Cx, correct deficiencies, re-verify equipment and components within the unfunctional system, including related systems as deemed required by Departmental Representative, to ensure effective performance.

.2 Costs for corrective work, additional tests, inspections, to determine acceptability and proper performance of such items to be borne by Contractor. Above costs to be in form of progress payment reductions or hold-back assessments.

1.5 PRE-CX REVIEW

.1 Before Construction:

.1 Review contract documents, confirm by writing to Departmental Representative.

.1 Adequacy of provisions for Cx.

.2 Aspects of design and installation pertinent to success of Cx.

.2 During Construction:

.1 Co-ordinate provision, location and installation of provisions for Cx.

.3 Before start of Cx:

.1 Have completed Cx Plan up-to-date.

.2 Ensure installation of related components, equipment, sub-systems, and systems is complete.

.3 Fully understand Cx requirements and procedures.

.4 Have Cx documentation shelf-ready.

.5 Understand completely design criteria and intent and special features.

.6 Submit complete start-up documentation to Departmental Representative.

.7 Have Cx schedules up-to-date.

.8 Ensure systems have been cleaned thoroughly.

.9 Complete TAB procedures on systems, submit TAB reports to Departmental Representative for review and approval.

.10 Ensure "As-Built" system schematics are available.

.4 Inform Departmental Representative in writing of discrepancies and deficiencies on finished works.

1.6 CONFLICTS

.1 Report conflicts between requirements of this section and other sections to Departmental Representative before start-up and obtain clarification.

.2 Failure to report conflict and obtain clarification will result in application of most stringent requirement.

1.7 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submittals: in accordance with Section 01 33 00 - Submittal Procedures.

.1 Submit no later than 4 weeks after award of Contract:

.1 Name of Contractor's Cx agent.

.2 Draft Cx documentation.

.3 Preliminary Cx schedule.

.2 Request in writing to Departmental Representative for changes to submittals and obtain written approval at least 8 weeks prior to start of Cx.

.3 Submit proposed Cx procedures to Departmental Representative where not specified and obtain written approval at least 8 weeks prior to start of Cx.

.4 Provide additional documentation relating to Cx process required by Departmental Representative.

1.8 COMMISSIONING DOCUMENTATION

.1 Refer to Section 01 91 33 - Commissioning (Cx) Forms: Installation Check Lists and Product Information (PI) / Performance Verification (PV) Forms for requirements and instructions for use.

.2 Refer to Section 23 08 00 Commissioning of Mechanical Systems.

.3 Departmental Representative to review and approve Cx documentation.

.4 Provide completed and approved Cx documentation to Departmental Representative.

1.9 COMMISSIONING SCHEDULE

.1 Provide detailed Cx schedule as part of construction schedule in accordance with Section 01 32 16.06 - Construction Progress Schedule - Critical Path Method (CPM).

.2 Provide adequate time for Cx activities prescribed in technical sections and commissioning sections including:

.1 Approval of Cx reports.

.2 Verification of reported results.

.3 Repairs, retesting, re-commissioning, re-verification.

.4 Training.

1.10 COMMISSIONING MEETINGS

.1 Convene Cx meetings as needed following project meetings: Section 01 32 16.06 - Construction Progress Schedule - Critical Path Method (CPM) and as specified herein.

.2 Purpose: to resolve issues, monitor progress, identify deficiencies, relating to Cx.

.3 Continue Cx meetings on regular basis until commissioning deliverables have been addressed.

.4 At 60% construction completion stage. Section 01 32 16.06 - Construction Progress Schedule - Critical Path Method (CPM). Departmental Representative to call a separate Cx scope meeting to review progress, discuss schedule of equipment start-up activities and prepare for Cx. Issues at meeting to include:

.1 Review duties and responsibilities of Contractor and subcontractors, addressing delays and potential problems.

.2 Determine the degree of involvement of trades in the commissioning process.

.5 Thereafter Cx meetings to be held until project completion and as required during equipment start-up and functional testing period.

.6 Meeting will be chaired by Cx Agent, who will record and distribute minutes.

.7 Ensure subcontractors are present at 60% and subsequent Cx meetings and as required.

1.11 STARTING AND TESTING

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

1.12 MANUFACTURER'S INVOLVEMENT

.1 Obtain manufacturers installation, start-up and operations instructions prior to start-up of components, equipment and systems and review with Departmental Representative

.1 Compare completed installation with manufacturer's published data, record discrepancies, and review with manufacturer.

.2 Modify procedures detrimental to equipment performance and review before start-up.

.2 Integrity of warranties:

.1 Use manufacturer's trained start-up personnel if required to maintain integrity of warranty.

.2 Verify with manufacturer that testing as specified will not void warranties.

.3 Qualifications of manufacturer's personnel:

.1 Experienced in design, installation and operation of equipment and systems.

.2 Ability to interpret test results accurately.

.3 To report results in clear, concise, logical manner.

1.13 PROCEDURES

.1 Verify that equipment and systems are complete, clean, and operating in normal and safe manner prior to conducting start-up, testing and Cx.

.2 Conduct start-up and testing in following distinct phases:

.1 Included in delivery and installation:

.1 Verification of conformity to specification, approved shop drawings and completion of PI report forms.

.2 Visual inspection of quality of installation.

.2 Start-up: follow accepted start-up procedures.

.3 Operational testing: document equipment performance.

.4 System PV: include repetition of tests after correcting deficiencies.

.5 Post-substantial performance verification: to include fine-tuning.

.3 Correct deficiencies and obtain approval from Departmental Representative after distinct phases have been completed and before commencing next phase.

.4 Document require tests on approved PV forms.

.5 Failure to follow accepted start-up procedures will result in re-evaluation of equipment by an independent testing agency selected by Departmental Representative. If results reveal that equipment start-up was not in accordance with requirements, and resulted in damage to equipment, implement following:

.1 Minor equipment/systems: implement corrective measures approved by Departmental Representative.

.2 If evaluation report concludes that major damage has occurred, Departmental Representative shall reject equipment.

.1 Rejected equipment to be remove from site and replace with new.

.2 Subject new equipment/systems to specified start-up procedures.

1.14 START-UP DOCUMENTATION

.1 Assemble start-up documentation and submit to Departmental Representative for approval before commencement of commissioning.

.2 Start-up documentation to include:

.1 Factory and on-site test certificates for specified equipment.

.2 Pre-start-up inspection reports.

.3 Signed installation/start-up check lists.

.4 Start-up reports,

.5 Step-by-step description of complete start-up procedures, to permit Departmental Representative to repeat start-up at any time.

1.15 OPERATION AND MAINTENANCE OF EQUIPMENT AND SYSTEMS

.1 After start-up, operate and maintain equipment and systems as directed by equipment/system manufacturer.

.2 With assistance of manufacturer develop written maintenance program and submit Departmental Representative for approval before implementation.

.3 Operate and maintain systems for length of time required for commissioning to be completed.

.4 After completion of commissioning, operate and maintain systems until issuance of certificate of interim acceptance.

1.16 TEST RESULTS

.1 If start-up, testing and/or PV produce unacceptable results, repair, replace or repeat specified starting and/or PV procedures until acceptable results are achieved.

.2 Provide manpower and materials, assume costs for re-commissioning.

1.17 START OF COMMISSIONING

.1 Notify Departmental Representative at least 21 days prior to start of Cx.

.2 Start Cx after elements of building affecting start-up and performance verification of systems have been completed.

1.18 INSTRUMENTS / EQUIPMENT

.1 Submit to Departmental Representative for review and approval:

.1 Complete list of instruments proposed to be used.

.2 Listed data including, serial number, current calibration certificate, calibration date, calibration expiry date and calibration accuracy.

.2 Provide the following equipment as required:

.1 Ladders.

.2 Equipment as required to complete work.

1.19 COMMISSIONING PERFORMANCE VERIFICATION

.1 Carry out Cx:

.1 Under accepted simulated operating conditions, over entire operating range, in all modes.

.2 On independent systems and interacting systems.

.2 Cx procedures to be repeatable and reported results are to be verifiable.

.3 Follow equipment manufacturer's operating instructions.

1.20 AUTHORITIES HAVING JURISDICTION

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

.2 Obtain certificates of approval, acceptance and compliance with rules and regulation of authority having jurisdiction.

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

1.21 EXTRAPOLATION OF RESULTS

.1 Do not extrapolate. Contractor and commissioning agent shall allow for seasonal visits to site for verification of systems operation within the warranty period.

1.22 EXTENT OF VERIFICATION

.1 Provide manpower and instrumentation to verify up to 30 % of reported results, unless specified otherwise in other sections.

.2 Number and location to be at discretion of Departmental Representative.

.3 Conduct tests repeated during verification under same conditions as original tests, using same test equipment, instrumentation.

.4 Review and repeat commissioning of systems if inconsistencies found in more than 20% of reported results.

.5 Perform additional commissioning until results are acceptable to Departmental Representative.

1.23 REPEAT VERIFICATIONS

.1 Assume costs incurred by Departmental Representative for third and subsequent verifications where:

.1 Verification of reported results fail to receive Departmental Representative's approval.

.2 Repetition of second verification again fails to receive approval.

.3 Departmental Representative deems Contractor's request for second verification was premature.

1.24 COMPLETION OF COMMISSIONING

.1 Upon completion of Cx leave systems in normal operating mode.

.2 Except for warranty and seasonal verification activities specified in Cx specifications, complete Cx prior to issuance of Interim Certificate of Completion.

.3 Cx to be considered complete when contract Cx deliverables have been submitted and accepted by Departmental Representative.

1.25 ACTIVITIES UPON COMPLETION OF COMMISSIONING

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

1.26 OCCUPANCY

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

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section Includes:

.1 Description of overall structure of Cx Plan and roles and responsibilities of Cx team.

.2 Related Requirements

.1 This section of the Specification forms part of the Contract Documents and is to be read, interpreted, and coordinated with all other parts.

1.2 REFERENCES

.1 American Water Works Association (AWWA)

.2 Public Works and Government Services Canada (PWGSC)

.1 PWGSC - Commissioning Guidelines CP.4 -3rd edition-03.

.3 Underwriters' Laboratories of Canada (ULC)

1.3 GENERAL

.1 Provide a fully functional facility:

.1 Systems, equipment and components meet user's functional requirements before date of acceptance, and operate consistently at peak efficiencies and within specified energy budgets under normal loads.

.2 Facility user and O M personnel have been fully trained in aspects of installed systems.

.3 Optimized life cycle costs.

.4 Complete documentation relating to installed equipment and systems.

.2 Term "Cx" in this section means "Commissioning".

.3 Use this Cx Plan as master planning document for Cx:

.1 Outlines organization, scheduling, allocation of resources, documentation, pertaining to implementation of Cx.

.2 Communicates responsibilities of team members involved in Cx Scheduling, documentation requirements, and verification procedures.

.3 Sets out deliverables relating to O M, process and administration of Cx.

.4 Describes process of verification of how built works meet design requirements.

.5 Produces a complete functional system prior to issuance of Certificate of Occupancy.

.6 Management tool that sets out scope, standards, roles and responsibilities, expectations, deliverables, and provides:

.1 Overview of Cx.

.2 General description of elements that make up Cx Plan.

.3 Process and methodology for successful Cx.

.4 Acronyms:

.1 Cx - Commissioning.
.2 BMM - Building Management Manual.
.3 EMCS - Energy Monitoring and Control Systems.
.4 MSDS - Material Safety Data Sheets.
.5 PI - Product Information.
.6 PV - Performance Verification.
.7 TAB - Testing, Adjusting and Balancing.
.8 WHMIS - Workplace Hazardous Materials Information System.

.5 Commissioning terms used in this Section:

.1 Bumping: short term start-up to prove ability to start and prove correct rotation.
.2 Deferred Cx - Cx activities delayed for reasons beyond Contractor's control due to lack of occupancy, weather conditions, need for heating/cooling loads.

1.4 DEVELOPMENT OF 100% CX PLAN

.1 Cx Plan to be 95% completed before added into Project Specifications.

.2 Cx Plan to be 100% completed within 8 weeks of award of contract to take into account:

.1 Approved shop drawings and product data.
.2 Approved changes to contract.
.3 Contractor's project schedule.
.4 Cx schedule.
.5 Contractor's, sub-contractor's, suppliers' requirements.
.6 Project construction team's and Cx team's requirements.

.3 Submit completed Cx Plan to Departmental Representative and obtain written approval.

1.5 REFINEMENT OF CX PLAN

.1 During construction phase, revise, refine and update Cx Plan to include:

.1 Changes resulting from Client program modifications.
.2 Approved design and construction changes.

.2 Revise, refine and update every 1 month during construction phase. At each revision, indicate revision number and date.

.3 Submit each revised Cx Plan to Departmental Representative for review and obtain written approval.

.4 Include testing parameters at full range of operating conditions and check responses of equipment and systems.

1.6 COMPOSITION, ROLES AND RESPONSIBILITIES OF CX TEAM

.1 Departmental Representative to maintain overall responsibility for project and is sole point of contact between members of commissioning team.

.2 Project Manager will select Cx Team consisting of following members:

.1 PWGSC Design Quality Review Team: during construction, will conduct periodic site reviews to observe general progress.

.2 PWGSC Quality Assurance Commissioning Manager: ensures Cx activities are carried out to ensure delivery of a fully operational project including:

.1 Review of Cx documentation from operational perspective.

.2 Review for performance, reliability, durability of operation, accessibility, maintainability, operational efficiency under conditions of operation.

.3 Protection of health, safety and comfort of occupants and O M personnel.

.4 Monitoring of Cx activities, training, development of Cx documentation.

.5 Work closely with members of Cx Team.

.3 Departmental Representative is responsible for:

.1 Organizing Cx.

.2 Monitoring operations Cx activities.

.3 Witnessing, certifying accuracy of reported results.

.4 Witnessing and certifying TAB and other tests.

.5 Developing BMM.

.6 Ensuring implementation of final Cx Plan.

.7 Performing verification of performance of installed systems and equipment.

.8 Implementation of Training Plan.

.4 Construction Team: contractor, sub-contractors, suppliers and support disciplines, is responsible for construction/installation in accordance with contract documents, including:

.1 Testing.

.2 TAB.

.3 Performance of Cx activities.

.4 Delivery of training and Cx documentation.

.5 Assigning one person as point of contact with Departmental Representative Cx Manager for administrative and coordination purposes.

.5 Contractor's Cx agent implements specified Cx activities including:

.1 Demonstrations.

.2 Training.

.3 Testing.

.4 Preparation, submission of test reports.

.6 Property Manager: represents lead role in Operation Phase and onwards and is responsible for:

.1 Receiving facility.

.2 Day-To-Day operation and maintenance of facility.

1.7 CX PARTICIPANTS

.1 Employ the following Cx participants to verify performance of equipment and systems:

.1 Installation contractor/subcontractor:

.1 Equipment and systems except as noted.

.2 Equipment manufacturer: equipment specified to be installed and started by manufacturer.

.1 To include performance verification.

.3 Specialist subcontractor: equipment and systems supplied and installed by specialist subcontractor.

.4 Specialist Cx agency:

.1 Possessing specialist qualifications and installations providing environments essential to client's program but are outside scope or expertise of Cx specialists on this project.

.5 Client: responsible for intrusion and access security systems.

.6 Ensure that Cx participant:

.1 Could complete work within scheduled time frame.

.2 Available for emergency and troubleshooting service during first year of occupancy by user for adjustments and modifications outside responsibility of O M personnel, including:

.1 Modify ventilation rates to meet changes in off-gassing.

.2 Changes to heating or cooling loads beyond scope of EMCS.

.3 Changes to control strategies beyond level of training provided to O M personnel.

.7 Provide names of participants to Departmental Representative and details of instruments and procedures to be followed for Cx 2 months prior to starting date of Cx for review and approval.

1.8 EXTENT OF CX

.1 Cx Structural and Architectural Systems:

.1 Architectural and structural:

.1 Doors, windows, related hardware:

.1 Special doors as identified herein:

.2 New door and window hardware.

.2 Commission mechanical systems and associated equipment:

.1 Plumbing systems:

.1 Domestic CWS and HWS.

.2 Regular sanitary waste systems.

.2 HVAC and exhaust systems:

.1 Heat recovery systems HRV-1 and HRV-2.

.3 Noise and vibration control systems for mechanical systems.

.1 HRV-1 and HRV-2.

.4 Seismic restraint and control measures.

.1 HRV-1 and HRV-2.

.5 Controls:

.1 For new HRV-1 and HRV-2.

.3 Commission electrical systems and equipment:

.1 Low voltage below 750 V:

.1 New low voltage equipment.

.2 New low voltage distribution systems.

.3 Relocated baseboard heater

.2 Lighting systems:

.1 New lighting equipment.

.2 New distribution systems.

1.9 DELIVERABLES RELATING TO O M PERSPECTIVES

.1 General requirements:

.1 Compile English documentation.

.2 Documentation to be computer-compatible format ready for inputting for data management.

.2 Provide deliverables:

.1 Warranties.

.2 Project record documentation.

.3 Inventory of spare parts, special tools and maintenance materials.

.4 Maintenance Management System (MMS) identification system used.

.5 WHMIS information.

.6 MSDS data sheets.

.7 Electrical Panel inventory containing detailed inventory of electrical circuitry for each panel board. Duplicate of inventory inside each panel.

1.10 DELIVERABLES RELATING TO THE CX PROCESS

.1 General:

.1 Start-up, testing and Cx requirements, conditions for acceptance and specifications form part of relevant technical sections of these specifications.

.2 Definitions:

.1 Cx as used in this section includes:

.1 Cx of components, equipment, systems, subsystems, and integrated systems.

.2 Factory inspections and performance verification tests.

.3 Deliverables: provide:

.1 Cx Specifications.

.2 Startup, pre-Cx activities and documentation for systems, and equipment.

.3 Completed installation checklists (ICL).

.4 Completed product information (PI) report forms.

.5 Completed performance verification (PV) report forms.

.6 Results of Performance Verification Tests and Inspections.

.7 Description of Cx activities and documentation.

.8 Description of Cx of integrated systems and documentation.

.9 Tests of following witnessed by PWGSC Design Quality Review Team:

.1 Proper operation of HRV-1 and HRV-2.

.10 Tests performed by Departmental Representative.

.11 Training Plans.

.12 Cx Reports.

.13 Prescribed activities during warranty period.

.4 Departmental Representative to witness and certify tests and reports of results provided to Departmental Representative.

.5 Departmental Representative to participate.

1.11 PRE-CX ACTIVITIES AND RELATED DOCUMENTATION

.1 Items listed in this Cx Plan include the following:

.1 Pre-Start-Up inspections: by Departmental Representative prior to permission to start up and rectification of deficiencies to Departmental Representative's satisfaction.

.2 Departmental Representative to use approved check lists.

.3 Departmental Representative will monitor some of these pre-start-up inspections.

.4 Include completed documentation with Cx report.

.5 Conduct pre-start-up tests: conduct pressure, static, flushing, cleaning, and "bumping" during construction as specified in technical sections. To be witnessed and certified by Departmental Representative and does not form part of Cx specifications.

.6 Departmental Representative will monitor some of these inspections and tests.

.7 Include completed documentation in Cx report.

.2 Pre-Cx activities - ARCHITECTURAL AND STRUCTURAL:

.1 Exterior walls: conduct thermographic surveys to ensure appropriate level of tightness after exterior envelope has been completed. Permanent HVAC systems are able to provide appropriate negative or positive pressure, a temperature of at 20 degrees C can be maintained between inside and outside and wind speed is less than 10 kph.

.2 Equipment:

.1 Kitchen equipment: As shown on architectural and mechanical drawings.

.3 Doors, windows, related hardware:

.1 Door and window hardware: As shown on architectural drawings.

.3 Pre-Cx activities - MECHANICAL:

.1 Plumbing, HVAC equipment and systems:

.1 "Bump" each item of equipment in its "stand-alone" mode.

.2 Complete pre-start-up checks and complete relevant documentation.

.3 After equipment has been started, test related systems in conjunction with control systems on a system-by-system basis.

.4 Perform TAB on systems. TAB reports to be approved by Departmental Representative.

.2 Controls:

.1 Perform testing in parallel with start-up.

.2 Carry out verification.

.3 Demonstrate performance of systems, to be witnessed by Departmental Representative prior to start of 30 day Final Acceptance Test period.

.4 Perform final Cx and operational tests during demonstration period and 30 day test period.

.5 Only additional testing after foregoing have been successfully completed to be "Off-Season Tests".

.4 Pre-Cx activities - ELECTRICAL:

.1 Low voltage distribution systems under 750 V:

.1 Requires independent testing agency to perform pre- energization and post-energization tests.

.2 Lighting systems: As shown on electrical drawings.

.3 Low voltage systems: these include:

.1 Low voltage lighting control systems.

.4 Security, surveillance and intrusion alarm systems (as applicable): to include verification by RCMP, Departmental Representative.

1.12 START-UP

.1 Start up components, equipment and systems.

.2 Equipment manufacturer, supplier, installing specialist sub-contractor, as appropriate, to start-up, under Contractor's direction, following equipment, systems:

.1 HRV-1 and HRV-2.

.3 Departmental Representative to monitor some of these start-up activities.

.1 Rectify start-up deficiencies to satisfaction of Departmental Representative.

.4 Performance Verification (PV):

.1 Approved Cx Agent or Division 23 contractor to perform.

.1 Repeat when necessary until results are acceptable to Departmental Representative.

.2 Use procedures to suit project requirements.

.3 Departmental Representative to witness and certify reported results using approved PI and PV forms.

.4 Departmental Representative to approve completed PV reports and provide to Contractor.

.5 Departmental Representative reserves right to verify up to 30% of reported results at random.

.6 Failure of randomly selected item shall result in rejection of PV report or report of system startup and testing.

1.13 CX ACTIVITIES AND RELATED DOCUMENTATION

.1 Perform Cx by specified Cx agency or Division 23 contractor using procedures developed by Departmental Representative and approved by Departmental Representative.

.2 Departmental Representative to monitor Cx activities.

.3 Upon satisfactory completion, Cx agency performing tests to prepare Cx Report using approved PV forms.

.4 Departmental Representative to witness, certify reported results of, Cx activities and forward to Departmental Representative.

.5 Departmental Representative reserves right to verify a percentage of reported results at no cost to contract.

1.14 CX OF INTEGRATED SYSTEMS AND RELATED DOCUMENTATION

.1 Cx to be performed by specified Cx specialist, using procedures developed by Cx specialist and approved by Departmental Representative.

.2 Tests to be witnessed by Departmental Representative and documented on approved report forms.

.3 Upon satisfactory completion, Cx specialist to prepare Cx Report, to be certified by Contractor and submitted to Departmental Representative for review.

.4 Departmental Representative reserves right to verify percentage of reported results.

.5 Integrated systems to include:

.1 HVAC and associated systems forming part of integrated HVAC systems: HRV-1 and HRV-2.

.6 Identification:

.1 In later stages of Cx, before hand-over and acceptance Departmental Representative, Contractor, and Cx Manager to co-operate to complete inventory data sheets and provide assistance to PWGSC in full implementation of MMS identification system of components, equipment, sub-systems, systems.

1.15 INSTALLATION CHECK LISTS (ICL)

.1 Refer to Section 01 91 33 - Commissioning (Cx) Forms: Installation Check Lists and Product Information (PI) / Performance Verification (PV) Forms.

1.16 PRODUCT INFORMATION (PI) REPORT FORMS

.1 Refer to Section 01 91 33 - Commissioning (Cx) Forms: Installation Check Lists and Product Information (PI) / Performance Verification (PV) Forms.

1.17 PERFORMANCE VERIFICATION (PV) REPORT

.1 Refer to Section 01 91 33 - Commissioning (Cx) Forms: Installation Check Lists and Product Information (PI) / Performance Verification (PV) Forms.

1.18 DELIVERABLES RELATING TO ADMINISTRATION OF CX

.1 General:

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

1.19 CX SCHEDULES

.1 Prepare detailed critical path Cx Schedule and submit to Departmental Representative for review and approval same time as project Construction Schedule. Include:

.1 Milestones, testing, documentation, training and Cx activities of components, equipment, subsystems, systems and integrated systems, including:

.1 Design criteria, design intents.

.2 Pre-TAB review: 28 days after contract award, and before construction starts.

.3 Cx agents' credentials: 30 days before start of Cx.

.4 Cx procedures: 1 month after award of contract.

.5 Cx Report format: 1 month after contract award.

.6 Discussion of heating/cooling loads for Cx: 1 month before start-up.

.7 Submission of list of instrumentation with relevant certificates: 21 days before start of Cx.

.8 Notification of intention to start TAB: 21 days before start of TAB.

.9 TAB: after successful start-up, correction of deficiencies and verification of normal and safe operation.

.10 Notification of intention to start Cx: 14 days before start of Cx.

.11 Notification of intention to start Cx of integrated systems: after Cx of related systems is completed 14 days before start of integrated system Cx.

.12 Identification of deferred Cx.

.13 Implementation of training plans.

.14 Cx reports: immediately upon successful completion of Cx.

.2 Detailed training schedule to demonstrate no conflicts with testing, completion of project and hand-over.

.3 6 months in Cx schedule for verification of performance in all seasons and wear conditions.

.2 After approval, incorporate Cx Schedule into Construction Schedule.

.3 Contractor, Contractor's Cx agent, and Departmental Representative will monitor progress of Cx against this schedule.

1.20 CX REPORTS

.1 Submit reports of tests, witnessed and certified by Departmental Representative to Departmental Representative who will verify reported results.

.2 Include completed and certified PV reports in properly formatted Cx Reports.

.3 Before reports are accepted, reported results to be subject to verification by Departmental Representative.

1.21 ACTIVITIES DURING WARRANTY PERIOD

.1 Cx activities must be completed before issuance of Interim Certificate, it is anticipated that certain Cx activities may be necessary during Warranty Period, including:

.1 Fine tuning of HVAC systems.

.2 Adjustment of ventilation rates to promote good indoor air quality and reduce deleterious effects of VOCs generated by off-gassing from construction materials and furnishings.

.3 Contractor and commissioning agent shall allow for seasonal visits to site for verification of systems operation within the warranty period.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section Includes:

.1 Commissioning forms to be completed for equipment, system and integrated system.

.2 Related Requirements

.1 This section of the Specification forms part of the Contract Documents and is to be read, interpreted, and coordinated with all other parts.

1.2 INSTALLATION/START-UP CHECK LISTS

.1 Include the following data:

.1 Product manufacturer's installation instructions and recommended checks.

.2 Special procedures as specified in relevant technical sections.

.3 Items considered good installation and engineering industry practices deemed appropriate for proper and efficient operation.

.2 Equipment manufacturer's installation/start-up check lists are acceptable for use. As deemed necessary by Departmental Representative supplemental additional data lists will be required for specific project conditions.

.3 Use check lists for equipment installation. Document check list verifying checks have been made, indicate deficiencies and corrective action taken.

.4 Installer to sign check lists upon completion, certifying stated checks and inspections have been performed. Return completed check lists to Departmental Representative. Check lists will be required during Commissioning and will be included in Building Maintenance Manual (BMM) at completion of project.

.5 Use of check lists will not be considered part of commissioning process but will be stringently used for equipment pre-start and start-up procedures.

1.3 PRODUCT INFORMATION (PI) REPORT FORMS

.1 Product Information (PI) forms compiles gathered data on items of equipment produced by equipment manufacturer, includes nameplate information, parts list, operating instructions, maintenance guidelines and pertinent technical data and recommended checks that is necessary to prepare for start-up and functional testing and used during operation and maintenance of equipment. This documentation is included in the BMM at completion of work.

.2 Prior to Performance Verification (PV) of systems complete items on PI forms related to systems and obtain Departmental Representative's approval.

1.4 PERFORMANCE VERIFICATION (PV) FORMS

.1 PV forms to be used for checks, running dynamic tests and adjustments carried out on equipment and systems to ensure correct operation, efficiently and function independently and interactively with other systems as intended with project requirements.

.2 PV report forms include those developed by Contractor records measured data and readings taken during functional testing and Performance Verification procedures.

.3 Prior to PV of integrated system, complete PV forms of related systems and obtain Departmental Representative's approval.

1.5 CHANGES AND DEVELOPMENT OF NEW REPORT FORMS

.1 When additional forms are required, but are not available from Departmental Representative develop appropriate verification forms and submit to Departmental Representative for approval prior to use.

.1 Additional commissioning forms to be in same format as provided by Departmental Representative

1.6 COMMISSIONING FORMS

.1 Use Commissioning forms to verify installation and record performance when starting equipment and systems.

.2 Strategy for Use:

.1 Contractor will provide required shop drawings information and verify correct installation and operation of items indicated on these forms.

.2 Confirm operation as per design criteria and intent.

.3 Identify variances between design and operation and reasons for variances.

.4 Verify operation in specified normal and emergency modes and under specified load conditions.

.5 Record analytical and substantiating data.

.6 Verify reported results.

.7 Form to bear signatures of recording technician and reviewed and signed off by Departmental Representative.

.8 Submit immediately after tests are performed.

.9 Reported results in true measured SI unit values.

.10 Provide Departmental Representative with originals of completed forms.

.11 Maintain copy on site during start-up, testing and commissioning period.

.12 Forms to be both hard copy and electronic format with typed written results in Building Management Manual in accordance with Section 01 91 51 - Building Management Manual (BMM).

1.7 LANGUAGE

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

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section Includes:

.1 This Section specifies roles and responsibilities of Commissioning Training.

.2 Related Requirements

.1 This section of the Specification forms part of the Contract Documents and is to be read, interpreted, and coordinated with all other parts.

1.2 TRAINEES

.1 Trainees: personnel selected for operating and maintaining this facility. Includes Facility Manager, building operators, maintenance staff, security staff, and technical specialists as required.

.2 Trainees will be available for training during later stages of construction for purposes of familiarization with systems.

1.3 INSTRUCTORS

.1 Departmental Representative will provide:

.1 Descriptions of systems.

.2 Instruction on design philosophy, design criteria, and design intent.

.2 Contractor: to provide instruction on the following:

.1 Start-Up, operation, shut-down of equipment, components and systems.

.2 Control features, reasons for, results of, implications on associated systems of, adjustment of set points of control and safety devices.

.3 Instructions on servicing, maintenance and adjustment of systems, equipment and components.

.3 Contractor to provide instruction on:

.1 Start-up, operation, maintenance and shut-down of equipment they have certified installation, started up and carried out PV tests.

1.4 TRAINING OBJECTIVES

.1 Training to be detailed and duration to ensure:

.1 Safe, reliable, cost-effective, energy-efficient operation of systems in normal and emergency modes under all conditions.

.2 Effective on-going inspection, measurements of system performance.

.3 Proper preventive maintenance, diagnosis and trouble-shooting.

.4 Ability to update documentation.

.5 Ability to operate equipment and systems under emergency conditions until appropriate qualified assistance arrives.

1.5 TRAINING MATERIALS

.1 Instructors to be responsible for content and quality.

.2 Training materials to include:

.1 "As-Built" Contract Documents.

.2 Operating Manual.

.3 Maintenance Manual.

.4 TAB and PV Reports.

.3 Project Manager, Commissioning Manager and Facility Manager will review training manuals.

.4 Training materials to be in a format that permits future training procedures to same degree of detail.

.5 Supplement training materials:

.1 Multimedia presentations.

.2 Manufacturer's training videos.

1.6 SCHEDULING

.1 Include in Commissioning Schedule time for training.

.2 Deliver training during regular working hours, training sessions to be up to 3 hours in length.

.3 Training to be completed prior to acceptance of facility.

1.7 RESPONSIBILITIES

.1 Be responsible for:

.1 Implementation of training activities,

.2 Coordination among instructors,

.3 Quality of training, training materials,

.2 Departmental Representative will evaluate training and materials.

.3 Upon completion of training, provide written report, signed by Instructors, witnessed by Departmental Representative.

1.8 TRAINING CONTENT

.1 Training to include demonstrations by Instructors using the installed equipment and systems.

.2 Content includes:

.1 Review of facility and occupancy profile.

.2 Functional requirements.

.3 System philosophy, limitations of systems and emergency procedures.

.4 Review of system layout, equipment, components and controls.

.5 Equipment and system start-up, operation, monitoring, servicing, maintenance and shut-down procedures.

.6 System operating sequences, including step-by-step directions for starting up, shut-down, operation of valves, dampers, switches, adjustment of control settings and emergency procedures.

.7 Maintenance and servicing.

.8 Trouble-shooting diagnosis.

.9 Inter-Action among systems during integrated operation.

.10 Review of O M documentation.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section Includes:

.1 This section is limited to portions of the Building Management Manual (BMM) provided to Departmental Representative by Contractor.

.2 Related Requirements

.1 This section of the Specification forms part of the Contract Documents and is to be read, interpreted, and coordinated with all other parts.

.2 Section 21 05 01 Common Work Results for Mechanical.

.3 Acronyms:

.1 BMM - Building Management Manual.

.2 Cx - Commissioning.

.3 HVAC - Heating, Ventilation and Air Conditioning.

.4 PI - Product Information.

.5 PV - Performance Verification.

.6 TAB - Testing, Adjusting and Balancing.

.7 WHMIS - Workplace Hazardous Materials Information System.

1.2 GENERAL REQUIREMENTS

.1 Standard letter size paper 216 mm x 279 mm.

.2 Methodology used to facilitate updating.

.3 Drawings, diagrams and schematics to be professionally developed.

.4 Electronic copy of data to be in a format accepted and approved by Departmental Representative. Refer to Submittals under Section 21 05 01 Common Work Results for Mechanical for further information.

1.3 APPROVALS

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

1.4 GENERAL INFORMATION

.1 Provide Departmental Representative the following for insertion into appropriate Part and Section of BMM:

.1 Complete list of names, addresses, telephone and fax numbers of contractor, sub-contractors that participated in delivery of project - as indicated in Section 1.2 of BMM.

.2 Summary of architectural, structural, mechanical and electrical systems installed and commissioned - as indicated in Section 1.4 of BMM.

.1 Including sequence of operation as finalized after commissioning is complete as indicated in Section 2.0 of BMM.

.3 Description of building operation under emergencies as indicated in Section 2.0 of BMM.

.4 System, equipment and components Maintenance Management System (MMS) identification - Section 2.1 of BMM.

.5 Information on operation and maintenance of architectural systems and equipment installed and commissioned - Section 2.0 of BMM.

.6 Information on operation and maintenance of applicable life safety systems and equipment installed and commissioned - Section 2.0 of BMM.

.7 Information on operation and maintenance of mechanical systems and equipment installed and commissioned - Section 2.0 of BMM.

.8 Operating and maintenance manual - Section 3.2 of BMM.

.9 Final commissioning plan as actually implemented.

.10 Completed commissioning checklists.

.11 Commissioning test procedures employed.

.12 Completed Product Information (PI) and Performance Verification (PV) report forms, approved and accepted by Departmental Representative.

.13 Commissioning reports.

1.5 CONTENTS OF OPERATING AND MAINTENANCE MANUAL

.1 For detailed requirements refer to Section 01 78 00 - Closeout Submittals.

.2 Departmental Representative to review and approve format and organization within 12 weeks of award of contract.

.3 Include original manufactures brochures and written information on products and equipment installed on this project.

.4 Record and organize for easy access and retrieval of information contained in BMM.

.5 Include completed PI report forms, data and information from other sources as required.

.6 Inventory directory relating to information on installed systems, equipment and components.

.7 Approved project shop-drawings, product and maintenance data.

.8 Manufacturer's data and recommendations relating: manufacturing process, installation, commissioning, start-up, O M, shutdown and training materials.

.9 Inventory and location of spare parts, special tools and maintenance materials.

.10 Warranty information.

.11 Inspection certificates with expiration dates, which require on-going re-certification inspections.

.12 Maintenance program supporting information including:

.1 Recommended maintenance procedures and schedule.

.2 Information to removal and replacement of equipment including, required equipment, points of lift and means of entry and egress.

1.6 SUPPORTING DOCUMENTATION FOR INSERTION INTO SUPPORTING APPENDICES

.1 Provide Departmental Representative supporting documentation relating to installed equipment and system, including:

- .1 General:
  - .1 Finalized commissioning plan.
  - .2 WHMIS information manual.
  - .3 Approved "as-built" drawings and specifications.
  - .4 Procedures used during commissioning.
  - .5 Cross-Reference to specification sections.
- .2 Architectural and structural:
  - .1 Inspection certificates, construction permits.
  - .2 PV reports.
- .3 Mechanical:
  - .1 Installation permits, inspection certificates.
  - .2 Piping pressure test certificates.
  - .3 Ducting leakage test reports.
  - .4 TAB and PV reports.
  - .5 Charts of valves.
  - .6 Copies of posted instructions.
- .4 Electrical:
  - .1 Installation permits, inspection certificates.
  - .2 TAB and PV reports.
  - .3 Electrical work log book.
  - .4 Charts and schedules.
  - .5 Locations of cables and components.
  - .6 Copies of posted instructions.

.2 Assist Departmental Representative with preparation of BMM.

1.7 LANGUAGE

.1 English Language.

1.8 IDENTIFICATION OF FACILITY

.1 When submitting information to Departmental Representative for incorporation into BMM, use following system for identification of documentation:

- .1 Confirm with Departmental Representative prior to submission.

1.9 USE OF CURRENT TECHNOLOGY

.1 Use current technology for production of documentation. Emphasis on ease of accessibility at all times, maintain in up-to-date state, compatibility with user's requirements.

.2 Obtain Departmental Representative's approval before starting Work.

Part 2 Products

2.1 NOT USED

.1 Not used.

Part 3 Execution

3.1 NOT USED

.1 Not used.

END OF SECTION

1.0 GENERAL

1.1 RELATED REQUIREMENTS

.1 Section 02 81 01 – Hazardous Materials

.2 Section 02 82 00-02 – Asbestos Abatement – Intermediate Precautions

.3 Section 02 87 13.15 – Mould Remediation – Maximum Precautions

1.2 REFERENCES

.1 CSA International

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

1.3 ACTION & INFORMATIONS SUBMITTALS

.1 Submit in accordance with Section 01 33 00 - Submittal Procedures and 01 74 21 - Construction/Demolition Waste Management Disposal.

1.4 SITE CONDITIONS

.1 If material resembling spray or trowel-applied asbestos or other designated substance listed as hazardous is encountered, stop work, take preventative measures, and notify Departmental Representative immediately.

.1 Proceed only after receipt of written instructions have been received from Departmental Representative.

.2 Notify Departmental Representative before disrupting building access or services.

.3 Extent of Demolition - refer to drawings including architectural, mechanical, and electrical.

3.0 EXECUTION

3.1 EXAMINATION

.1 Inspect building with Departmental Representative and verify extent and location of items designated for removal, disposal, alternative disposal, recycling, salvage and items to remain.

.2 Locate and protect utilities. Preserve active utilities traversing site in operating condition.

.3 Notify and obtain approval of utility companies before starting demolition.

.4 Disconnect, cap, plug or divert, as required, existing utilities within the building where they interfere with the execution of the work, in conformity with the requirements of the authorities having jurisdiction. Mark the location of these and previously capped or plugged services on the site and indicate location (horizontal and vertical) on the record drawings. Support, shore up and maintain pipes and conduits encountered.

.1 Immediately notify Departmental Representative and the Owner concerned in case of damage to any utility or service designated to remain in place.

.2 Immediately notify the Departmental Representative should uncharted utility or service be encountered, and await instruction in writing regarding remedial action.

3.2 PREPARATION

.1 Protection of In-Place Conditions:

.1 Prevent movement, settlement, or damage to adjacent structures, and utilities.

.2 Keep noise, dust, and inconvenience to occupants to minimum.

.3 Protect building systems, services and equipment.

.4 Provide temporary dust screens, covers, railings, supports and other protection as required.

.5 Do Work in accordance with Section 01 35 33 - Health and Safety Requirements.

3.3 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.

.1 Leave Work area clean at end of each day.

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

END OF SECTION 02 41 99

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 01 01 50 – General Instructions

.2 Section 01 33 00 – Submittal Procedures

.3 Section 01 35 33 - Health and Safety Requirements

.4 Section 01 74 21 – Construction Demolition Waste Management and Disposal

.5 Section 01 74 11 – Cleaning

.6 Section 02 82 00.02 – Asbestos Abatement – Intermediate Precautions

.7 Section 02 87 13.15 – Precautions for Mould Remediation – Maximum Precautions

1.2 REFERENCES

.1 Reports (herein referred to as the Previous Environmental Reports):

.1 DST Consulting Engineers Inc. report – Building #E0841 – 450 Gibson Street, Tofino, BC, Pre-Renovation Hazardous Material Assessment, dated July 29, 2019.

.2 Pinchin Ltd. report – Asbestos Building Materials Survey Report – Building #E0841, dated March 14, 2019.

.3 WSP Canada Inc. report – Building Name – RCMP Housing, 450 Gibson Street, Tofino, BC, Building Envelope Condition Assessment, dated April 1, 2019.

.1 Copies of the Previous Environmental Reports are attached in Appendix C of the Project Specifications.

.2 Definitions:

.1 Dangerous Goods: product, substance, or organism specifically listed or meets hazard criteria established in Transportation of Dangerous Goods Regulations.

.2 Hazardous Material: product, substance, or organism used for its original purpose; and is either dangerous goods or material that will cause adverse impact to environment or adversely affect health of persons, animals, or plant life when released into the environment.

.3 Hazardous Waste: hazardous material no longer used for its original purpose and that is intended for recycling, treatment or disposal.

.4 Hazardous Building Material: component of a building or structure that will cause adverse impact to environment or adversely affect health of persons, animals, or plant life when altered, disturbed or removed during maintenance, renovation or demolition.

.3 Reference Standards:

.1 Canadian Environmental Protection Act,1999 (CEPA 1999)

.1 Export and Import of Hazardous Waste and Hazardous Recyclable Material Regulations (SOR/2005-149).

.2 Department of Justice Canada

.1 Transportation of Dangerous Goods Act, 1992 (TDG Act) 1992, (c. 34).

.2 Transportation of Dangerous Goods Regulations (T-19.01-SOR/2001-286).

.3 Health Canada / Workplace Hazardous Materials Information System (WHMIS)

.1 Material Safety Data Sheets (MSDS).

.4 National Research Council Canada Institute for Research in Construction (NRC-IRC)

.1 National Fire Code of Canada (2015).

.5 WorkSafe BC

.1 British Columbia's Occupational Health and Safety Regulation (BC Reg. 296/97, including amendments to date of work)

.2 "Safe Work Practices for Handling Asbestos" (latest edition)

.3 "Safe Work Practices for Handling Lead" (latest edition)

.6 British Columbia Hazardous Waste Regulation (BC Reg. 63/88)

.7 The Federal PCB Regulations (SOR/2008-273).

.8 The British Columbia Waste Management Act - Ozone Depleting Substances and Other Halocarbons Regulation (BC Reg. 387/99).

.9 The Federal Halocarbons Regulation (July 2003).

.10 Canadian Construction Association

.1 Standard Construction Document CCA 82 "Mould Guidelines for the Canadian Construction Industry" (2004)

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data for hazardous materials to be used by the Contractor to complete the Work:

.1 Submit manufacturer's instructions, printed product literature and data sheets, and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Submit two copies of WHMIS MSDS in accordance with Section 01 35 29.06 - Health and Safety Requirements to Departmental Representative for each hazardous material required prior to bringing hazardous material on site.

.3 Submit hazardous materials management plan to Departmental Representative that identifies hazardous materials, usage, location, personal protective equipment requirements, and disposal arrangements.

.4 Construction/Demolition Waste Management:

.1 Submit calculations on end-of-project recycling rates, salvage rates, and landfill rates demonstrating percentage of construction/demolition wastes were recycled or salvaged

.5 Low-Emitting Materials: submit listing of adhesives and sealants used in building, comply with VOC and chemical component limits or restrictions requirements.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle hazardous materials to be used by the Contractor to complete the Work in accordance with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver hazardous materials to be used by the Contractor to site in original factory packaging, labelled with manufacturer's name and address.

.3 Transport hazardous materials and wastes in accordance with Transportation of Dangerous Goods Act, Transportation of Dangerous Goods Regulations, and applicable provincial regulations.

.4 Storage and Handling Requirements:

- .1 Co-ordinate storage of hazardous materials to be used by the Contractor to complete the Work with Departmental Representative and abide by internal requirements for labelling and storage of materials and wastes.
- .2 Store and handle hazardous materials and wastes in accordance with applicable federal and provincial laws, regulations, codes, and guidelines.
- .3 Store and handle flammable and combustible materials in accordance with National Fire Code of Canada requirements.
- .4 Keep no more than 45 litres of flammable and combustible liquids such as gasoline, kerosene and naphtha for ready use.
  - .1 Store flammable and combustible liquids in approved safety cans bearing the Underwriters' Laboratory of Canada or Factory Mutual seal of approval.
  - .2 Storage of quantities of flammable and combustible liquids exceeding 45 litres for work purposes requires the written approval of the Departmental Representative.
- .5 Transfer of flammable and combustible liquids is prohibited within buildings.
- .6 Transfer flammable and combustible liquids away from open flames or heat-producing devices.
- .7 Solvents or cleaning agents must be non-flammable or have flash point above 38 degrees C.
- .8 Store flammable and combustible waste liquids for disposal in approved containers located in safe, ventilated area. Keep quantities to minimum.
- .9 Observe smoking regulations, smoking is prohibited in areas where hazardous materials are stored, used, or handled.
- .10 Storage requirements for quantities of hazardous materials and wastes in excess of 5 kg for solids, and 5 litres for liquids:
  - .1 Store hazardous materials and wastes in closed and sealed containers.
  - .2 Label containers of hazardous materials and wastes in accordance with WHMIS.
  - .3 Store hazardous materials and wastes in containers compatible with that material or waste.
  - .4 Segregate incompatible materials and wastes.
  - .5 Ensure that different hazardous materials or hazardous wastes are stored in separate containers.
  - .6 Store hazardous materials and wastes in secure storage area with controlled access.
  - .7 Maintain clear egress from storage area.
  - .8 Store hazardous materials and wastes in location that will prevent them from spilling into environment.

.9 Have appropriate emergency spill response equipment available near storage area, including personal protective equipment.

.10 Maintain inventory of hazardous materials and wastes, including product name, quantity, and date when storage began.

.11 When hazardous waste is generated on site:

.1 Co-ordinate transportation and disposal with Departmental Representative.

.2 Comply with applicable federal, provincial and municipal laws and regulations for generators of hazardous waste.

.3 Use licensed carrier authorized by provincial authorities to accept subject material.

.4 Before shipping material obtain written notice from intended hazardous waste treatment or disposal facility it will accept material and it is licensed to accept this material.

.5 Label containers with legible, visible safety marks as prescribed by federal and provincial regulations.

.6 Only trained personnel handle, offer for transport, or transport dangerous goods.

.7 Provide photocopy of shipping documents and waste manifests to Departmental Representative.

.8 Track receipt of completed manifest from consignee after shipping dangerous goods. Provide photocopy of completed manifest to Departmental Representative.

.9 Report discharge, emission, or escape of hazardous materials immediately to Departmental Representative and appropriate provincial authority. Take reasonable measures to control release.

.12 Ensure personnel have been trained in accordance with Workplace Hazardous Materials Information System (WHMIS) requirements.

.13 Report spills or accidents immediately to Departmental Representative. Submit a written spill report to Departmental Representative within 24 hours of incident.

.5 Include provisions for Work of this Section in Waste Reduction Workplan as outlined in Section 01 74 21 – Construction/Demolition Waste Management and Disposal.

Part 2 Products

2.1 MATERIALS

.1 Description:

.1 Bring on site only quantities hazardous material required to perform Work.

.2 Maintain MSDS in proximity to where materials are being used. Communicate this location to personnel who may have contact with hazardous materials.

Part 3 Execution

3.1 HAZARDOUS MATERIALS ABATEMENT

.1 Scope of Abatement Activities.

.1 Abatement shall be conducted to handle, alter, remove and/or dispose of hazardous building materials as identified in the Previous Environmental Reports in accordance with applicable regulations, guidelines, standards and/or best practices for such work, where such identified hazardous building materials will be impacted (handled, altered, damaged, removed) by the Work.

.2 Contractor is responsible for reviewing plans, specifications and reports such that they understand the locations and amounts of hazardous materials that will be impacted by the Work of this contract, and such that appropriate plans and budgets can be included in their overall bids.

.3 The listing below is a summary of the identified hazardous building material categories and associated removal and disposal regulations, guidelines and/or standards, based on the project scope of work.

.1 Asbestos-Containing Materials (ACMs)

.1 Refer to the Previous Environmental Reports for identities and locations of ACMs that may require disturbance during the Work, including, but not limited to include:

.1 Drywall joint compound located throughout the building.

.2 Ceiling texture coating applied to ceilings throughout the building.

.2 Actions that will disturb identified ACMs are to be conducted in accordance with the requirements of the WorkSafe BC publication “Safe Work Practices for Handling Asbestos”, latest edition, by appropriately trained personnel, further detailed below.

.1 Submit WorkSafeBC Notice of Project Form no less than five (5) business days prior to start of work, to Departmental Representative.

.2 Submit proof of Contractor's Asbestos Liability Insurance.

.3 Submit to Departmental Representative necessary permits for transportation and disposal of asbestos containing waste and proof that asbestos containing waste has been received and properly disposed of, within twenty (20) business days after disposal.

.4 Submit proof that all asbestos workers and/or supervisor have received appropriate training and education by a competent person in the hazards of asbestos exposure, good personal hygiene and work practices while working in Asbestos Work Areas, and the use, cleaning and disposal of respirators and protective clothing, within five (5) business days prior to start of work, to Departmental Representative. Instruction and training related to respirators is to include, at a minimum:

.5 Fitting of equipment.

.6 Inspection and maintenance of equipment.

.7 Disinfecting of equipment.

.8 Limitations of equipment.

.9 Waste transportation to be conducted in accordance with BC Reg. 63/88 and the Federal Transportation of Dangerous Goods Regulation.

.10 Waste disposal to be conducted in accordance with BC Reg. 63/88.

.11 Notify Departmental Representative immediately of suspected ACM discovered during Work and not apparent from drawings, specifications, or report pertaining to Work. Do not disturb such material pending instructions from Departmental Representative.

.2 Lead and Lead-Containing Paints (LCPs)

.1 Refer to the Previous Environmental Reports for identification and locations of lead-containing materials (including LCPs) that may require disturbance during the Work.

.2 Actions that will disturb lead-containing materials (including paints and materials coated with LCPs) are to be conducted in accordance with the requirements of the current version of the WorkSafe BC publication “Safe Work Practices for Handling Lead”, latest edition, keeping airborne exposure to lead dust to less than the 8-hour Occupational Exposure Limit (OEL) for lead of 0.05 milligram per cubic metre (mg/m^3).

.3 Disturbance to LCPs are not expected to be required during the Work.

.1 Refer to the provisions of the WorkSafe BC publication “Safe Work Practices for Handling Lead”, latest edition, for removal of LCPs from surfaces before any welding and torch-cutting, should the Contractor plan to use such methods to complete the Work.

.1 Contractor will be responsible for verification testing of surfaces where LCPs have been removed. Confirmation of acceptable results is to be provided to the Departmental Representative for review before proceeding with any welding or torch-cutting on surfaces where LCPs were present.

.4 Waste transportation to be conducted in accordance with BC Reg. 63/88 and the Federal Transportation of Dangerous Goods Regulation.

.5 Waste disposal to be conducted in accordance with BC Reg. 63/88.

.3 Mould

.1 The intent of this work is to remove (clean) surface mould from the ceiling surfaces in the Southeast Bedroom and Corner Bedroom areas in the building. Cleaning will involve the application of a cleaning solution to identified mould growth, cleaning of mould growth, and the application of an oil-based primer, containing a mould-inhibitor.

.2 Removal (surface cleaning) of mould-impacted framing members and roof sheeting in the attic space of the building.

.3 Removal and disposal of fiberglass insulation contaminated by mould spores.

.4 Removal and disposal of installed soffit baffles located in the attic of the building.

.5 Upon completion of surface cleaning, encapsulation of framing members and roof sheeting in the attic space of the building using an oil-based primer, containing a mould-inhibitor.

.6 All mould remediation is to be completed in accordance with the requirements of the Canadian Construction Association, Mould Guideline for the Canadian Construction Industry, latest edition.

.4 Mercury

.1 Removal, alteration and/or disposal of mercury-containing equipment is not anticipated to be required during the Work.

.5 Ozone-Depleting Substances (ODSs)

.1 Removal, alteration and/or disposal of ozone-depleting substances is not anticipated to be required during the Work.

.6 Silica

.1 Removal, alteration and/or disposal silica-containing materials is not anticipated to be required during the Work.

3.2 CLEANING

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

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

.3 Waste Management: separate waste materials for reuse and recycling.

.1 Dispose of hazardous waste materials in accordance with applicable federal and provincial acts, regulations, and guidelines.

.2 Send hazardous wastes to authorized hazardous waste disposal or treatment facilities.

.3 Burning, diluting, or mixing hazardous wastes for purpose of disposal is prohibited.

.4 Disposal of hazardous materials in waterways, storm or sanitary sewers, or in municipal solid waste landfills is prohibited.

.5 Dispose of hazardous wastes in weekly in accordance with applicable federal and provincial regulations.

.6 Minimize generation of hazardous waste to so all hazardous waste generated daily is packaged in accordance with applicable federal and provincial acts, regulations, and guidelines. Take necessary precautions to avoid mixing clean and contaminated wastes.

.7 Identify and evaluate recycling and reclamation options as alternatives to land disposal, such as:

.1 Hazardous wastes recycled in manner constituting disposal.

.2 Hazardous waste burned for energy recovery.

.3 Lead-acid battery recycling.

.4 Hazardous wastes with economically recoverable precious metals.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Comply with requirements of this Section when performing following Work:

.1 Cleaning mould contamination from asbestos-containing ceiling texture coating in the Southeast Bedroom and Corner Bedroom areas in the building.

1.2 SECTION INCLUDES

.1 Requirements and procedures for asbestos abatement of minor amounts of chrysotile asbestos-containing materials of the type describe within.

1.3 RELATED SECTIONS

.1 Section 01 01 50 – General Instructions.

1.4 REFERENCES

.1 Canadian General Standards Board (CGSB).

.1 CAN/CGSB-1.205-94, Sealer for Application of Asbestos-Fibre Releasing Materials.

.2 Department of Justice Canada (Jus).

.1 Canadian Environmental Protection Act, 1999 (CEPA).

.3 Health Canada/Workplace Hazardous Materials Information System (WHMIS).

.1 Material Safety Data Sheets (MSDS).

.4 Transport Canada (TC).

.1 Transportation of Dangerous Goods Act, 1992 (TDGA).

.5 Underwriters' Laboratories of Canada (ULC).

1.5 DEFINITIONS

.1 HEPA vacuum: High Efficiency Particulate Air filtered vacuum equipment with filter system capable of collecting and retaining fibres greater than 0.3 microns in any dimension at 99.97% efficiency.

.2 Amended Water: water with non-ionic surfactant wetting agent added to reduce water tension to allow wetting of fibres.

.3 Asbestos-Containing Materials (ACMs): materials identified under Existing Conditions Article, including fallen materials and settled dust.

.4 Minor Amounts of ACMs: less than or equal to 0.1 m^2 of friable material containing chrysotile asbestos.

.5 Asbestos Work Area: area where work takes place which will, or may disturb ACMs.

.6 Authorized Visitors: Engineers, or designated representatives, and representatives of regulatory agencies.

.7 Friable Material: material that when dry can be crumbled, pulverized or powdered by hand pressure and includes such material that is crumbled, pulverized or powdered.

.8 Occupied Area: any area of building or work site that is outside Asbestos Work Area.

.9 Polyethylene: polyethylene sheeting or rip-proof polyethylene sheeting with tape along edges, around penetrating objects, over cuts and tears, and elsewhere as required to provide protection and isolation.

.10 Glove Bag: prefabricated glove bag as follows:

- .1 Minimum thickness 0.25 mm polyvinyl-chloride bag.
- .2 Integral 0.25 mm thick polyvinyl-chloride gloves and elastic ports.
- .3 Equipped with reversible double-pull double throw zipper on top and at approximately mid-section of the bag.
- .4 Straps for sealing ends around pipe.
- .5 Must incorporate internal closure strip if it is to be moved or used in more than one specific location.

.11 Sprayer: garden reservoir type sprayer or airless spray equipment capable of producing mist or fine spray. Must have appropriate capacity for scope of work.

1.6 SUBMITTALS

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

.2 Submit proof satisfactory to Departmental Representative that suitable arrangements have been made to dispose of asbestos-containing waste in accordance with requirements of authority having jurisdiction.

.3 Submit Provincial/Territorial and/or local requirements for Notice of Project Form.

.4 Submit proof of Contractor's Asbestos Liability Insurance.

.5 Submit to Departmental Representative necessary permits for transportation and disposal of asbestos-containing waste and proof that asbestos-containing waste has been received and properly disposed.

.6 Submit proof satisfactory to Departmental Representative that employees have had instruction on hazards of asbestos exposure, respirator use, dress, entry and exit from Asbestos Work Area, and aspects of work procedures and protective measures.

.7 Submit proof that supervisory personnel have attended asbestos abatement course, of not less than two days duration, approved by Departmental Representative. Minimum of one supervisor for every ten workers.

.8 Submit Worker's Compensation Board status and transcription of insurance.

.9 Submit documentation including test results, fire and flammability data, and Material Safety Data Sheets (MSDS) for chemicals or materials including:

.1 encapsulants;

.2 amended water;

.3 slow-drying sealer.

.4 Any additional controlled products brought and/or used on-site.

1.7 QUALITY ASSURANCE

.1 Regulatory Requirements: comply with Federal, Provincial/Territorial and local requirements pertaining to asbestos, provided that in case of conflict among these requirements or with these specifications more stringent requirement applies. Comply with regulations in effect at the time work is performed.

.2 Health and Safety:

.1 Do construction occupational health and safety in accordance with Section 01 35 33 - Health and Safety Requirements.

.2 Safety Requirements: worker and visitor protection.

.1 Protective equipment and clothing to be worn by workers while in Asbestos Work Area include:

.1 Non-powered reusable or replaceable filter-type respirator equipped with HEPA filter cartridges, personally issued to worker and marked as to efficiency and purpose, suitable for protection against asbestos and acceptable to Provincial Authority having jurisdiction.

.2 Disposable-type protective clothing that does not readily retain or permit penetration of asbestos fibres, consisting of full-body covering including head covering with snug-fitting cuffs at wrists, ankles, and neck.

.2 Eating, drinking, chewing, and smoking are not permitted in Asbestos Work Area.

.3 Before leaving Asbestos Work Area, dispose of protective clothing as contaminated waste as specified.

.4 Ensure workers wash hands and face when leaving Asbestos Work Area.

.5 Ensure that no person required to enter an Asbestos Work Area has facial hair that affects seal between respirator and face.

.3 Visitor Protection:

.1 Provide protective clothing and approved respirators to Authorized Visitors to work areas.

.2 Instruct Authorized Visitors in the use of protective clothing, respirators and procedures.

.3 Instruct Authorized Visitors in proper procedures to be followed in entering into and exiting from Asbestos Work Area.

1.8 WASTE MANAGEMENT AND DISPOSAL

.1 Disposal of asbestos waste generated by removal activities must comply with Federal, Provincial/Territorial and Municipal regulations. Dispose of asbestos waste in sealed double thickness 6 mm bags or leak proof drums. Label containers with appropriate warning labels.

.2 Provide manifests describing and listing waste created. Transport containers by approved means to licenced landfill for burial.

1.9 EXISTING CONDITIONS

.1 Reports and information pertaining to material containing chrysotile asbestos to be handled, removed, or otherwise disturbed and disposed of during this Project are bound into this specification immediately after this Section.

.2 Notify Departmental Representative of friable material discovered during Work and not apparent from drawings, specifications, or report pertaining to Work. Do not disturb such material until instructed by Departmental Representative.

1.10 DEPARTMENTAL REPRESENTATIVE'S INSTRUCTIONS

.1 Before beginning Work, provide Departmental Representative satisfactory proof that every worker has had instruction and training in hazards of asbestos exposure, in personal hygiene and work practices, in use of glove bag procedures, and in use, cleaning, and disposal of respirators and protective clothing.

.2 Instruction and training related to respirators includes, at minimum:

.1 Fitting of equipment.
.2 Inspection and maintenance of equipment.
.3 Disinfecting of equipment.
.4 Limitations of equipment.

.3 Instruction and training must be provided by competent, qualified person.

Part 2 Products

2.1 MATERIALS

.1 Drop and Enclosure Sheets.

.1 Polyethylene: 0.15 mm thick.
.2 FR polyethylene: 0.15 mm thick woven fibre reinforced fabric bonded both sides with polyethylene.

.2 Wetting Agent: 50% polyoxyethylene ester and 50% polyoxyethylene ether mixed with water in concentration to provide thorough wetting of asbestos-containing material.

.3 Waste Containers: contain waste in two separate containers.

.1 Inner container: 0.15 mm thick sealable polyethylene bag.
.2 Outer container: sealable metal or fibre type where there are sharp objects included in waste material; otherwise outer container may be sealable metal or fibre type or second 0.15 mm thick sealable polyethylene bag.
.3 Labelling requirements: affix preprinted cautionary asbestos warning, in both official languages, that is visible when ready for removal to disposal site.

.4 Glove bag:

.1 Acceptable materials: safe-T-Strip products in configuration suitable for Work, or Alternative material approved by addendum during tendering period in accordance with Instructions to Tenderers.

.2 Glove bags intended for use in more than one location must be equipped with reversible, double-pull, double-throw zipper on top and at approximately mid-section of bag.

.5 Tape: tape suitable for sealing polyethylene to surfaces under both dry and wet conditions using amended water.

.6 Slow - drying sealer: non-staining, clear, water - dispersible type that remains tacky on surface for at least 8 hours and designed for purpose of trapping residual asbestos fibres.

.1 Sealer: flame spread and smoke developed rating less than 50.

.7 Encapsulant: penetrating type conforming to CAN/CGSB-1.205.

Part 3 Execution

3.1 SUPERVISION

.1 Minimum of one Supervisor for every ten workers is required.

.2 Approved Supervisor must remain within Asbestos Work Area during disturbance, removal, or other handling of asbestos-containing materials.

3.2 PROCEDURES

.1 Do construction occupational health and safety in accordance with Section 01 35 33 - Health and Safety Requirements.

.2 Before beginning Work, at each access to Asbestos Work Area, install warning signs in both official languages in upper case 'Helvetica Medium' letters reading as follows, where number in parentheses indicates font size to be used : 'CAUTION ASBESTOS HAZARD AREA (25 mm) / NO UNAUTHORIZED ENTRY (19 mm) / WEAR ASSIGNED PROTECTIVE EQUIPMENT (19 mm) / BREATHING ASBESTOS DUST MAY CAUSE SERIOUS BODILY HARM (7 mm)'.

.3 Before beginning Work remove visible dust from surfaces in work area where dust is likely to be disturbed during course of work.

.1 Use HEPA vacuum, or damp cloths where damp cleaning does not create hazard and is otherwise appropriate.

.2 Do not use compressed air to clean up or remove dust from any surface.

.4 Prevent spread of dust from Asbestos Work Area using measures appropriate to work to be done.

.1 Use FR polyethylene drop sheets over flooring such as carpeting that absorbs dust and over flooring in work areas where dust or contamination cannot otherwise be safely contained.

.2 When cleaning mould contamination from asbestos-containing ceiling texture coat, erect enclosure of polyethylene sheeting around work area, shut off mechanical ventilation system serving work area and seal ventilation ducts to and from work area.

.5 Remove loose material by HEPA vacuum; thoroughly wet friable material containing asbestos to be removed or disturbed before and during Work unless wetting creates hazard or causes damage.

.1 Use garden reservoir type low - velocity sprayer or airless spray equipment capable of producing mist or fine spray.

.2 Perform Work in a manner to reduce dust creation to lowest levels practicable.

.6 Work is subject to visual inspection and air monitoring. Contamination of surrounding areas indicated by visual inspection or air monitoring will require complete enclosure and clean-up of affected areas.

.7 Clean-up:

.1 Frequently during Work and immediately after completion of work, clean up dust and asbestos-containing waste using HEPA vacuum or by damp mopping.

.2 Place dust and asbestos-containing waste in sealed dust-tight waste bags. Treat drop sheets and disposable protective clothing as asbestos waste and wet and fold to contain dust and then place in waste bags.

.3 Immediately before their removal from Asbestos Work Area and disposal, clean each filled waste bag using damp cloths or HEPA vacuum and place in second clean waste bag.

.4 Seal and remove double-bagged waste from site. Dispose of in accordance with requirements of Provincial/Territorial and Federal authority having jurisdiction. Supervise dumping and ensure that dump operator is fully aware of hazardous nature of material to be dumped and that guidelines and regulations for asbestos disposal are followed.

.5 Perform final thorough clean-up of Asbestos Work Areas and adjacent areas affected by Work using HEPA vacuum.

3.3 AIR MONITORING

.1 From beginning of Work until completion of cleaning operations, Departmental Representative to take air samples on daily basis inside and outside of Asbestos Work Area enclosures in accordance with Health Canada and WorkSafeBC requirements.

.2 If air monitoring shows that areas outside Asbestos Work Area enclosures are contaminated, enclose, maintain and clean these areas in same manner as that applicable to Asbestos Work Area.

.3 Ensure that respiratory safety factors are not exceeded.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 This Section has been designed to provide general practices and procedures for:

.1 Removing and disposing of more than ten square metres of mould contaminated materials, including settled dust.

.2 Preventing cross-contamination between contaminated areas and adjacent or nearby uncontaminated areas.

.3 Protecting personnel during remediation.

1.2 REFERENCES

.1 CCA 82-2004, Canadian Construction Association, Mould Guidelines for the Canadian Construction Industry, latest edition.

.2 Health Canada/Workplace Hazardous Materials Information System (WHMIS)

.1 Material Safety Data Sheets (MSDS).

1.3 DEFINITIONS

.1 Authorized Visitors: Departmental Representatives or designated representatives, and representatives of regulatory agencies.

.2 Cleaning solution: detergent solution

.3 Competent person: individuals acceptable to Departmental Representative who can demonstrate that mould remediation training has been obtained, is capable of identifying existing microbial hazards in workplace and selecting appropriate control strategy for microbial exposure.

.4 Contractor: remediation contractor providing demolition and removal services as defined in specifications.

.5 Critical barrier or enclosure: minimum of two separate layers of 0.15 mm fibre reinforced polyethylene sheeting (FRPS) tarp taped securely and separately over windows, doorways, diffusers, grilles and any other openings between work area and uncontaminated areas outside of work area including outside of building.

.6 Curtained doorway: arrangement of closures to allow ingress and egress from one room to another. Typically constructed as follows: Place two overlapping sheets (minimum overlap of 1 metre or width of doorway) of FRPS tarp over existing or temporarily framed doorway, securing each along top of doorway, securing vertical edge of one sheet along one vertical side of doorway and securing vertical edge of other sheet along opposite vertical side of doorway. Reinforce free edges of FRPS, tarp with fibre reinforced adhesive tape and weight bottom edge to ensure proper closing. Space curtained doorways a minimum of two (2) metres apart.

.7 Decontamination Room: enclosure located between Mould Contaminated Work Area and uncontaminated area for decontamination of equipment and workers, typically consisting of two curtained doorways at least 2 metres apart.

.8 Fibre Reinforced Polyethylene Sheet (FRPS): rip-proof polyethylene sheeting with fibre reinforced adhesive tape added along edges.

.9 HEPA vacuum: High Efficiency Particulate Air filtered vacuum equipment with filter system capable of collecting and retaining particles greater than 0.3 microns at 99.97% efficiency.

.10 HVAC: heating ventilating and air-conditioning systems which serve occupied areas. Includes but is not limited to air handling units, duct work, terminal boxes and grills.

.11 Mould Contaminated Work Area (MCWA): specific area or location where actual work is being performed or such other area of facility which it has been determined may be hazardous to public health as result of mould remediation.

.12 Negative pressure: maintain Mould Contaminated Work Area at negative pressure relative to surrounding space to prevent contaminants from leaving contaminated area. Use exhaust fan with HEPA filter to maintain Mould Contaminated Work Area at lower pressure than surrounding areas. Maintain pressure differential of 5 to 7 Pa. Air flow movement can be verified with smoke pencil.

.13 Occupied Area: areas of building or work site that are outside Mould Contaminated Work Area.

.14 PPE: Personnel Protective Equipment.

.15 Sprayer: garden reservoir type sprayer or airless spray equipment capable of producing mist or fine spray; with minimum of six litres capacity for work.

1.4 REGULATORY REQUIREMENTS

.1 Comply with regulations in effect at time work is performed. In case of conflict among these requirements or with these specifications more stringent requirement applies. If no regulations exist, follow guidelines as listed in paragraph 1.2 References.

.2 Comply with British Columbia Regulation BC.Reg. 296/97, Part 4, Parts 4.70 – 4.80.

1.5 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit proof satisfactory to Departmental Representative that employees have had instruction on potential hazards of mould exposure, use of personal respirator and protective clothing, entry and exit from work areas and aspects of work procedures and protective measures.

.2 Submit proof of attendance in form of certificate that supervisory personnel have been trained in mould remediation course, approved by Departmental Representative. Minimum of one supervisor for every ten trained workers.

.3 Submit Provincial and/or local requirements for Notice of Project form.

.4 Submit proof of Contractors Liability Insurance for dealing with hazardous materials.

.5 Submit WorkSafeBC (WSIB) status and transcription of insurance.

1.6 INSTRUCTION AND TRAINING

.1 Before commencing work, provide Departmental Representative proof that workers have had instruction and training in potential health hazards of mould exposure, handling of hazardous materials, in personal hygiene including protective clothing, entry and exit from Mould Contaminated Work Area, use of disposal procedures including building materials, respirators and protective clothing.

.2 Instruction and training related to use of personal respirators:

.1 Fitting of equipment.

.2 Inspection and maintenance of equipment.

.3 Disinfecting of equipment.

.4 Limitations of equipment.

.3 Instruction and training must be provided by designated construction safety advisor.

.4 Supervisory personnel to complete required training in mould remediation.

1.7 WORKER PROTECTION

.1 Provide tight-fitting full-face dual cartridge air purifying respirator equipped with HEPA filter cartridges, as a minimum to be worn. Disposable respirators not allowed.

.2 Gloves that extend to middle of forearm.

.3 Use mould/dust-impervious polyethylene coated disposable head and foot coverings, and full body suit. Seal gaps, such as those around ankles and wrists, with fibre reinforced adhesive tape.

.4 Procedures for entering Mould Contaminated Work Area. Each worker to:

.1 Remove street clothes in Decontamination Room and put on respirator with new filters or reusable filters, clean disposable protective clothing and head covers before entering Mould Contaminated Work Area. Store street clothes, uncontaminated footwear and towels in Decontamination Room.

.2 Ensure that no person required to enter Mould Contaminated Work Area has facial hair that affects seal between respirator and face.

.3 Eating, drinking and chewing are not permitted in Mould Contaminated Work Area. Drinking is permitted in Decontamination Area.

.5 Procedures for exiting Mould Contaminated Work Area. Workers to:

.1 Remove gross contamination from clothing before leaving work area then proceed to Decontamination Room and remove disposable protective clothing except respirators. Place contaminated worksuits in closed containers for disposal with mould contaminated materials.

.2 Clean outside of respirator with cleaning solution. Remove respirator, remove and dispose of filters in container provided for purpose. Wash and rinse inside of respirator.

.3 When not in use in work area, store reusable work footwear in Decontamination Room. Upon completion of mould remediation, clean footwear thoroughly inside and out using cleaning solution before removing from Mould Contaminated Work Area or from Decontamination Room.

.4 Proceed to decontamination room and change into street clothes at end of each day's work.

.5 If re-entering work area, follow entering and exiting procedures.

.6 Workers: to be fully protected with respirators and protective equipment clothing during preparation of erecting enclosure prior to commencing actual mould remediation.

.7 Post in Decontamination room procedures specified.

1.8 VISITOR PROTECTION

.1 Protective clothing and approved full face respirators to be worn by Authorized Visitors to Mould Contaminated Work Area.

.2 Instruct Authorized Visitors in proper use of protective clothing, respirators, and procedures.

.3 Instruct Authorized Visitors proper procedures to be followed in entering into and exiting from Mould Contaminated Work Area.

.4 Provide and facilitate access to Departmental Representative at all times during construction progress at no additional cost to contract.

1.9 SITE CONDITIONS

.1 Inform sub-trades of presence of mould-contaminated materials and potential health hazards of mould exposure.

.2 Submit to Departmental Representative copy of notifications prior to start of work.

1.10 EXISTING CONDITIONS

.1 Greater than ten square metres of mould contaminated materials (roof sheeting and framing) has been identified in the attic space of the building. Existing attic insulation is exposed and will require removal in conjunction with mould remediation work.

.2 Mould-impacted materials that have been previously identified and are to be handled, removed, or otherwise disturbed and disposed of during this project are identified within the document listed below. The referenced report contains background information; investigation methodology; findings; conclusions and recommendations; and includes appended drawings of the work areas. This specification shall be read and interpreted in association with the referenced technical report included in Appendix C.

.1 Building Envelope Condition Assessment, RCMP Housing, 450 Gibson Street, Tofino, BC. Prepared by WSP Canada Inc., dated April 18, 2019.

Part 2 PRODUCTS

2.1 MATERIALS

.1 Drop Sheets: fibre reinforced polyethylene 0.15 mm thick woven fibre reinforced fabric bonded both sides with polyethylene.

.2 Disposal bags: dust-tight 0.15 mm clear polyethylene waste bags.

.3 Wetting Agent: water to mist mould-containing material.

.4 Cleaning solution: detergent solution for damp wipe and/or mop.

.5 Fibre reinforced adhesive tape: used in sealing joints of fibre reinforced polyethylene sheets and for attachment of fibre reinforced polyethylene sheet to finished and unfinished surfaces. Fibre reinforced adhesive tape must be capable of adhering under both dry and wet conditions.

.6 Provide materials such as fibre reinforced polyethylene sheeting, lumber, nails and hardware necessary to construct and dismantle barriers that isolate Mould Contaminated Work Area.

2.2 TOOLS AND EQUIPMENT

.1 Tools and equipment: suitable for use with microbial contamination and must be able to withstand de-contamination.

.2 Personnel protective equipment (protective clothing, personal respiratory filter cartridges, HEPA air filters, etc.) provide in sufficient quantities for duration of project.

.3 Exhaust air fan systems: equipped with HEPA filters and be capable of providing sufficient exhaust air to create a minimum pressure differential of 5 Pa to 7 Pa and to

allow sufficient flow of air through area (minimum of 4 air exchanges per hour). Negative air units exhausting indoors will require on-site DOP testing certification.

.4 Pressure differential measurement instrument: provide to ensure exhaust air devices provide minimum pressure differential required between Mould Contaminated Work Area and uncontaminated areas. Install equipment in critical barrier between Mould Contaminated Work Area and uncontaminated areas and gap seal with fibre reinforced adhesive tape.

.5 Vacuum cleaners: HEPA filters.

.6 Ladders and/or scaffolds: adequate length, strength and sufficient quantity to support work schedule.

Part 3 EXECUTION

3.1 PREPARATION OF MOULD CONTAMINATED WORK AREAS

.1 Mould Contaminated Work Area and areas adjacent and around area to be unoccupied: Vacating is required for infants (less than 12 months old), elderly people, persons having undergone recent surgery, immune suppressed people or people with chronic inflammatory lung diseases.

.2 One supervisor for every ten trained mould remediation workers is required.

.3 Approved supervisor must remain within Mould Contaminated Work Area during disturbance, removal, or other handling of mould-contaminated materials.

.4 Turn off HVAC systems serving Mould Contaminated Work Areas prior to starting remediation work to prevent contamination and dust dispersal to other areas of building.

.5 Remove existing insulation in the attic space and dispose of insulation as mould contaminated wastes.

.6 Clean fixed objects within proposed work area using HEPA filtered vacuum, damp wipe surfaces and enclose with 2 separate layers of 0.15 mm fibre reinforced polyethylene sheeting securely sealed with fibre reinforced adhesive tape.

.7 Remove visible dust from surfaces in work area where dust is likely to be disturbed during course of mould remediation work. Use HEPA vacuum and damp wipe area.

.8 Do not use compressed air to clean up or remove dust from surfaces.

.9 Seal off pathways between the work area and uncontaminated areas to prevent spread of dirt and spores with 2 separate layers of 0.15 mm (fibre reinforced polyethylene sheeting securely held in place by fibre reinforced adhesive tape. Doorways/access hatch(s) and corridors that will not be used for passage during work must be sealed with fixed critical barriers.

.10 Erect critical barriers around perimeter of Mould Contaminated Work Area before remediation using two separate layers of 0.15 mm fibre reinforced polyethylene sheeting extending from floor slab to as close as possible to underside of above floor slab. Seal gaps due to ductwork, piping conduits with 2 separate layers of 0.15 mm fibre reinforced polyethylene sheeting. For larger areas, erect steel or wooden stud frame and fibre reinforced polyethylene sheeting attached to it. Frame openings greater than 3 square metres with 38 x 89 mm studs spaced 400 mm on center. Barriers must be constructed without disturbing contaminated materials.

.11 Seal floor and wall surfaces within enclosure which are not to be removed as microbial waste with minimum of 2 separate layers of 0.15 mm polyethylene sheeting. Cover floors

first so that fibre reinforced polyethylene extends at least 300 mm and fold up against enclosure wall, overlap vertical fibre reinforced polyethylene sheet with floor fold up.

.12 Build worker Decontamination Room at exits from work areas.

.13 Put negative pressure system in operation and operate continuously from time first fibre reinforced polyethylene is installed to seal openings until final completion of work including final clean-up. Negative air units exhausting indoors will require on-site DOP testing certification.

.14 After Mould Contaminated Work Area enclosure is completed, remove HVAC filters, pack in sealed plastic bags 0.15 mm minimum thickness and treat as contaminated waste. Remove objects that might interfere with mould removal, as directed by Departmental Representative. Use HEPA vacuum during removal to reduce dust dispersal.

.15 Before beginning mould remediation work, at each access to Mould Contaminated Work Area, install warning signs in upper case 'Helvetica Medium' letters reading as follows, where number in parentheses indicates font size to be used: 'CAUTION MOULD HAZARD AREA (25 mm) / NO UNAUTHORIZED ENTRY (19 mm) / WEAR ASSIGNED PROTECTIVE EQUIPMENT (19 mm) / BREATHING MOULD DUST MAY CAUSE SERIOUS BODILY HARM (7 mm)'.

.16 Do not begin remediation work until barriers are inspected and authorization is given by the Departmental Representative.

3.2 PREPARATION OF WORKER DECONTAMINATION ENCLOSURE SYSTEM

.1 Establish worker decontamination enclosure system between Mould Contaminated Work Area and uncontaminated area. Access to Mould Contaminated work area through this enclosure.

.2 Access to Decontamination Room through double flap curtained openings.

.3 Decontamination Room: build Decontamination Room between Mould Contaminated Work Areas, with two curtained doorways, one to Mould Contaminated Work Area and one to uncontaminated areas. Install waste receptor and storage facilities for workers' shoes and protective clothing to be re-worn in Decontamination Room. Decontamination Room: large enough to accommodate specified facilities, equipment needed, and at least one worker allowing sufficient space to change clothes comfortably. Provide storage for clean protective clothing and respiratory equipment. Install mirror to permit workers to fit respiratory equipment properly. Ensure wash facilities, including warm water and soap, to allow for worker denomination and cleaning.

.4 No personnel permitted to leave Decontamination Room unless first decontaminated by changing, wet cleaning or HEPA vacuuming to remove dust and mould spores. No contaminated materials or persons to enter uncontaminated area.

3.3 MAINTENANCE OF ENCLOSURES

.1 Maintain enclosures in tidy condition.

.2 Ensure that barriers and fibre reinforced polyethylene linings are effectively sealed with duct tape at beginning of each working period. Repair damaged barriers and remedy defects immediately upon discovery.

.3 Use smoke methods to test effectiveness of barriers when directed by Departmental Representative.

3.4 MICROBIAL REMEDIATION WORK AREAS

.1 Commence mould remediation work when:

.1 Mould Contaminated Work Areas and decontamination enclosures are effectively segregated from parts of building required to remain in use. Enclosures are to be inspected and approved by Departmental Representative.

.2 Tools, equipment and materials waste containers are on site.

.3 Building security has been set up.

.4 Warning signs as specified are displayed where access to contaminated areas is possible.

.5 Notifications have been completed and preparatory steps have been taken.

.2 Authorized supervisor employed by contractor and qualified in microbial contamination remediation to be on job site to ensure establishment and maintenance of negative pressure enclosure and proper work practices throughout project.

.3 Do not begin remediation work until authorized by Departmental Representative.

.4 Use sprayer low-velocity, fine mist to mist where materials containing mould are to be removed. Perform work to reduce dust creation to lowest levels practicable.

.5 Remove microbially contaminated materials (insulation, roof sheeting, framing, etc.). Removal to include visibly contaminated material as determined by Departmental Representative.

.6 Remove contaminated material in small sections within enclosure. Pack material in sealable plastic bags 0.15 mm minimum thickness and place in containers for disposal.

.7 Non-porous (e.g. metals, glass and plastics) and semi-porous (e.g. wood studs, furniture) materials that are identified as contaminated can be cleaned using HEPA-filtered vacuuming and damp wiping with detergent solution and reused depending on depth to which microbial growth has penetrated substrate. Wood is to be discarded if fungal growth has affected its soundness. Authorization for only cleaning is subject to written approval by Departmental Representative.

.8 Where designed waste container is not used, remove sealed containers containing mould waste and dispose following specified procedures in Section 3.7 Waste Disposal.

.9 During mould remediation, should the Departmental Representative suspect contamination of areas outside enclosed Mould Contaminated Work Area, contractor to stop remediation work and immediately decontaminate these affected areas. Eliminate causes of such contamination. Unprotected individuals prohibited from entering these contaminated areas until air and swab sampling and visual inspections determine areas are free of contamination.

3.5 REPAIR AND CLEAN-UP

.1 During mould remediation and immediately after completion of mould remediation, clean enclosure starting within top of enclosure and working down to floors. Clean both enclosed area and Decontamination Room using HEPA vacuum and/or by damp mopping with cleaning solution.

.2 HEPA vacuum inside layer of polyethylene sheeting within work area and damp wiped prior to removal. Removal of this layer to occur after removal and decontamination activities are completed and work area inspected by Departmental Representative.

.3 Upon completion of 3.5.1 and 3.5.2, the Contractor will spray-apply an oil-based primer containing an antimicrobial agent to all roof sheeting and framing members to remain in the mould remediation work area.

.4 Remove inside layer of fibre reinforced polyethylene sheeting by rolling it away from walls to centre of work area. Vacuum visible debris during cleanup, immediately, using HEPA vacuum.

.5 HEPA vacuum, after inside layer of fibre reinforced polyethylene sheeting has been removed, second layer of polyethylene sheeting and damp wipe.

.6 Include Decontamination Room in similar clean-up.

.7 Remove non-essential fibre reinforced polyethylene sheetings and visible accumulations of material and debris.

.8 Dispose of used fibre reinforced polyethylene sheets; used fibre reinforced adhesive tape, cleaning material, clothing, and contaminated waste.

.9 Include sealed waste containers and equipment used in Mould Contaminated Work Areas in cleanup and removed from work areas, via Decontamination Room.

3.6 INSPECTION AND AIR SAMPLING

.1 Carry out final visual inspection check to ensure that no dust or debris remains on surfaces as result of dismantling operations. All work is subject to final inspection and written approval by Departmental Representative. No additional costs will be allowed by Contractor for additional labour or materials required to provide specified performance level.

.2 The Departmental Representative may perform final clearance air, swab, and/or tape lift sampling prior to re-occupancy. Sample results will be compared to an outdoor reference sample or samples collected from an area known to not be impacted by mould for comparative purposes. Repeat cleaning using HEPA vacuum equipment, or damp cleaning methods, in conjunction with sampling until levels comparative to the reference samples, at the sole discretion and decision of the Departmental Representative. No additional costs will be allowed by Contractor for additional labour or materials required to provide specified performance level.

.3 Upon notification that final tests are acceptable remove remaining critical barriers. HEPA vacuum surfaces behind containment barriers, including walls, floors, ceiling tiles, windows, doors and other surfaces, as applicable. HEPA vacuum adjacent interior spaces within 3 metres of former location of containment barriers.

3.7 WASTE DISPOSAL

.1 Place debris and microbial waste in doubled-bagged dust-tight 0.15 mm clear polyethylene waste bags. Treat drop sheets and disposable protective clothing as waste; fold these items to contain dust, and place in plastic bags. Securely seal bags and place in waste containers for transport.

.2 Cover large items that have heavy mould growth with two layers of polyethylene sheeting and sealed with fibre reinforced adhesive tape before they are removed from cleaned work area.

.3 Clean outside of bags and/or waste containers with damp cloth and cleaning solution or HEPA vacuumed prior to their transport to uncontaminated areas of building.

.4 Remove waste bags and/or containers from site and dispose. There is no special requirement for disposal of mouldy materials; as such they can be disposed of in landfill.

.5 All waste routes, waste disposal schedule, and waste storage are subject to written approval by Departmental Representative.

3.8 RE-ESTABLISHMENT OF MOVABLE OBJECTS AND SYSTEMS

.1 Return objects moved to temporary locations to their original location. Ensure objects are cleaned before been moved into cleaned area.

.2 Remount objects to former positions.

END OF SECTION

1.0 GENERAL

1.1 RELATED REQUIREMENTS

.1 Finish Carpentry — Section 06 20 00

.2 Architectural Woodwork — Section 06 40 00

1.2 REFERENCES

.1 CSA International

.1 CSA B111- 1974 (R2003), Wire Nails, Spikes and Staples.

.2 CSA O121- 08, Douglas Fir Plywood.

.3 CAN/CSA-O141- 05, Softwood Lumber.

.4 CSA O151- 09, Canadian Softwood Plywood.

.5 CAN/CSA-O325.0- 07, Construction Sheathing.

.2 National Lumber Grades Authority (NLGA)

.1 Standard Grading Rules for Canadian Lumber 2000.

.3 South Coast Air Quality Management District (SCAQMD), California State, Regulation XI. Source Specific Standards

.1 SCAQMD Rule 1113- A2007, Architectural Coatings.

1.3 ACTION & INFORMATIONAL SUBMITTALS

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

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for rough carpentry work and include product characteristics, performance criteria, physical size, finish and limitations.

1.4 QUALITY ASSURANCE

.1 Lumber identification: by grade stamp of an agency certified by Canadian Lumber Standards Accreditation Board.

.2 Plywood identification: by grade mark in accordance with applicable CSA standards.

.3 Plywood, OSB and wood based composite panel construction sheathing identification: by grademark in accordance with applicable CSA standards.

.4 Sustainable Standards Certification:

.1 Certified Wood: submit listing of wood products and materials used in accordance with FSC-STD-01-001.

1.5 DELIVERY, STORAGE & HANDLING

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

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

.3 Storage and Handling Requirements:

.1 Store materials off ground indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect wood from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

2 .0 PRODUCTS

2.1 MATERIALS

.1 Lumber: unless specified otherwise, softwood, S4S, moisture content 19% or less in accordance with following standards:
- .1 CAN/CSA-O141.
- .2 NLGA Standard Grading Rules for Canadian Lumber.
- .3 FSC certified.

.2 Furring, blocking, nailing strips, grounds, rough bucks, curbs, fascia backing and sleepers:
- .1 Board sizes: "Standard" or better grade.
- .2 Dimension sizes: "Standard" light framing or better grade.
- .3 Post and timbers sizes: "Standard" or better grade.

.3 Panel Materials:
- .1 Douglas fir plywood (DFP): to CSA O121, standard construction.
  - .1 Urea-formaldehyde free.
- .2 Canadian softwood plywood (CSP): to CSA O151, standard construction.
  - .1 Urea-formaldehyde free.
- .3 Plywood, OSB and wood based composite panels: to CAN/CSA-O325.
  - .1 Urea-formaldehyde free.

.4 Wood Preservative:
- .1 Surface-applied wood preservative: clear coloured, or 5% pentachlorophenol solution, water repellent preservative.
- .2 Pentachlorophenol use is restricted to building components that are in ground contact and subject to decay or insect attack only. Where used, pentachlorophenol-treated wood must be covered with two coats of an appropriate sealer.
- .3 Structures built with wood treated with pentachlorophenol and inorganic arsenicals must not be used for storing food nor should the wood come in contact with drinking water.

.5 Primers: in accordance with manufacturer's recommendations for surface conditions:
- .1 Primer: VOC limit 100 g/L maximum to GS-11 and SCAQMD Rule 1113.
- .2 Paint: VOC limit 50 g/L maximum to GS-11 SCAQMD Rule 1113.
- .3 Coating: VOC limit 100 g/L maximum to GS-11 SCAQMD Rule 1113.

.6 Fire retardant treated wood:
- .1 All plywood back board in Welding Shop area to be fire retardant treated wood to limit the frame spread rating to <25 and be pressure impregnated with fire-retardant chemicals in conformance with CAN/CSA-080 Series-M “Wood Preservation”.

2.2 ACCESSORIES

.1 Fasteners: to CAN/CSA-G164, for interior highly humid areas pressure-preservative, fire-retardant treated lumber.

.2 Nails, spikes and staples: to CSA B111.

.3 Bolts: 12.5 mm diameter unless indicated otherwise, complete with nuts and washers.

.4 Proprietary fasteners: toggle bolts, expansion shields and lag bolts, screws and lead or inorganic fibre plugs recommended for purpose by manufacturer.

3.0 EXECUTION

3.1 EXAMINATION

.1 Verification of Conditions: verify conditions of substrates previously installed under other Sections or Contracts are acceptable for rough carpentry 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 PREPARATION

.1 Treat surfaces of material with wood preservative, before installation.

.2 Apply preservative by dipping, or by brush to completely saturate and maintain wet film on surface for minimum 3-minute soak on lumber and 1-minute soak on plywood.

.3 Re-treat surfaces exposed by cutting, trimming or boring with liberal brush application of preservative before installation.

3.3 INSTALLATION

.1 Comply with requirements of NBC, supplemented by the following paragraphs.

.2 Install furring and blocking as required to space-out and support casework, cabinets, wall and ceiling finishes, facings, fascia, soffit, siding and other work as required.

.3 Align and plumb faces of furring and blocking to tolerance of 1:600.

.4 Install rough bucks, nailers and linings to rough openings as required to provide backing for frames and other work.

.5 Install wood cants, fascia backing, nailers, curbs and other wood supports as required and secure using galvanized steel fasteners.

.6 Install wood backing, dressed, tapered and recessed slightly below top surface of roof insulation for roof hopper.

.7 Install sleepers as indicated.

.8 Use caution when working with particle board. Use dust collectors and high quality respirator masks.

.9 Frame, anchor, fasten, tie and brace members to provide necessary strength and rigidity.

.10 Countersink bolts where necessary to provide clearance for other work.

3.4 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.

.1 Leave work area clean at end of each day.

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

END OF SECTION 06 08 99

1.0 GENERAL

1.1 RELATED REQUIREMENTS

.1	Rough Carpentry for Minor Works	Section 06 08 99
.2	Architectural Woodwork	Section 06 40 00
.3	Door Hardware	Section 08 71 00

1.2 REFERENCES

.1 Architectural Woodwork Manufacturers Association of Canada (AWMAC) and Woodwork Institute (WI)
- .1 North American Architectural Woodwork Standards (NAAWS), latest edition.

.2 Canadian General Standards Board (CGSB)
- .1 CAN/CGSB-11.3-M87, Hardboard.

.3 CSA International
- .1 CSA B111-74(R2003), Wire Nails, Spikes and Staples.
- .2 CAN/CSA G164-M92 (R2003), Hot Dip Galvanizing of Irregularly Shaped Articles.
- .3 CSA O121-08, Douglas Fir Plywood.
- .4 CSA O141-05, Softwood Lumber.
- .5 CSA O151-09, Canadian Softwood Plywood.
- .6 CSA O153-M1980 (R2008), Poplar Plywood.

.4 National Lumber Grades Authority (NLGA)
- .1 NLGA Standard Grading Rules for Canadian Lumber 2008.

.5 Underwriters Laboratories of Canada (ULC)
- .1 CAN4-S104-80(R1985), Standard Method for Fire Tests of Door Assemblies.
- .2 CAN/ULC-S105-09, Standard Specification for Fire Door Frames.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:
- .1 Submit manufacturer's instructions, printed product literature and data sheets for plywood MDF and include product characteristics, performance criteria, physical size, finish and limitations.
- .2 Submit two copies of WHMIS MSDS in accordance with Section 01 35 33 - Health and Safety Requirements.

.3 Shop Drawings:
- .1 Submit drawings stamped and signed by professional engineer registered or licensed in Province of British Columbia, Canada.
- .2 Indicate details of construction, profiles, jointing, fastening and other related details.
- .3 Indicate materials, thicknesses, finishes and hardware.

.4 Samples:
- .1 Submit for review and acceptance of each unit.
- .2 Samples will be returned for inclusion into work.
- .3 Submit duplicate 300 x 300 mm samples of finished wainscot panel.

.5 Certifications: submit certificates signed by manufacturer certifying materials comply with specified performance characteristics and physical properties.

.6 Test and Evaluation Reports: submit certified test reports for composite wood from approved independent testing laboratories, indicating compliance with specifications for specified performance characteristics and physical properties.

1.4 QUALITY ASSURANCE

.1 Lumber by grade stamp of agency certified by Canadian Lumber Standards Accreditation Board (CLSAB).

.2 Plywood, particleboard, OSB and wood based composite panels to CSA and ANSI standards.

.3 Wood fire rated frames and panels: listed and labelled by an organization accredited by Standards Council of Canada to CAN4-S104 and CAN/ULC-S105.

1.5 DELIVERY, STORAGE AND HANDLING

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

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

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

.4 Develop Construction Waste Management Plan Waste Reduction Workplan related to Work of this Section

.5 Packaging Waste Management: remove for reuse of pallets, crates, padding, and packaging materials as specified in Construction Waste Management Plan in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal

2.0 PRODUCTS

2.1 MATERIALS

.1 Softwood lumber: S4S, moisture content 19% or less in accordance with following standards:
- .1 CSA O141.
- .2 NLGA Standard Grading Rules for Canadian Lumber
- .3 AWMAC custom or premium grade, where noted, moisture content as specified.
- .4 Machine stress-rated lumber is acceptable.
- .5 Hardwood lumber: moisture content in accordance:
  - .1 AWMAC custom grade, moisture content as specified.

.2 Panel Material: Urea-formaldehyde free
- .1 Recycled content: provide information indicating recycled content on a % (Post-Consumer + ½ Post-Industrial)
- .2 FSC certified.

.3 Douglas fir plywood (DFP): to CSA O121, standard construction. 6.1.5 and 6.2.5 where both sides exposed to view.

.4 Hardwood plywood: to ANSI/HPVA HP-1.

2.2 ACCESSORIES

.1 Nails and staples: to CSA B111; galvanized to CAN/CSA-G164 for exterior work, interior humid areas and for treated lumber; plain finish elsewhere.

.2 Wood screws: plain, type and size to suit application.

.3 Splines: wood

.4 Adhesive and Sealants: in accordance with Section 07 92 00 - Joint Sealants.

3 .0 EXECUTION

3.1 EXAMINATION

.1 Verification of Conditions: verify conditions of substrates previously installed under other Sections or Contracts are acceptable for wood products 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 finish carpentry to AWMAC’s standards.

.2 Scribe and cut as required, fit to abutting walls, and surfaces, fit properly into recesses and to accommodate piping, columns, fixtures, outlets, or other projecting, intersecting or penetrating objects.

.3 Form joints to conceal shrinkage.

3.3 CONSTRUCTION

.1 Fastening:

.1 Position items of finished carpentry work accurately, level, plumb, true and fasten or anchor securely.

.2 Design and select fasteners to suit size and nature of components being joined. Use proprietary devices as recommended by manufacturer.

.3 Set finishing nails to receive filler. Where screws are used to secure members, countersink screw in round smooth cut hole and plug with wood plug to match material being secured.

.4 Replace items of finish carpentry with damage to wood surfaces including hammer and other bruises.

.2 Standing and running trim:

.1 Butt and cope internal joints of baseboards to make snug, tight, joint. Cut right angle joints of casing and base with mitred joints.

.2 Fit backs of baseboards and casing snugly to wall surfaces to eliminate cracks at junction of base and casing with walls.

.3 Make joints in baseboard, where necessary using a 45 degrees scarf type joint.

.4 Install door and window trim in single lengths without splicing.

.3 Interior frames:
.1 Set frames with plumb sides and level heads and sills and secure.

.4 Handrails
.1 Install handrails in locations indicated.
.2 Make joints hair line, dowelled and glued.
.3 Install support brackets as indicated.
.4 Install brackets at ends and at 1200 mm on centre minimum at intermediate spacings.
.5 Install metal backing plates between studs at bracket locations to ensure proper support for brackets and bolts or self-tapping screws.
.6 Secure using counter sunk screws plugged with matching wood plugs.

.5 Other:
.1 Install other specialties including
.1 Door hardware

3.4 CLEANING

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

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

.3 Waste Management: separate waste materials for recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal
.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.5 PROTECTION

.1 Protect installed products and components from damage during construction.

.2 Repair damage to adjacent materials caused by finish carpentry installation.

END OF SECTION 06 20 00

1.0 GENERAL

1.1 RELATED REQUIREMENTS

.1	Rough Carpentry for Minor Works	Section 06 08 99
.2	Joint Sealants	Section 07 92 00
.3	Painting	Section 09 91 23

1.2 REFERENCES

.1 Architectural Woodwork Manufacturers Association of Canada (AWMAC) and Woodwork Institute (WI)
- .1 North American Architectural Woodwork Standards (NAAWS), latest edition.

.2 Canadian General Standards Board (CGSB)
- .1 CAN/CGSB-71.20-M88, Adhesive, Contact, Brushable.

.3 CSA International
- .1 CSA B111-74 (R2003), Wire Nails, Spikes and Staples.
- .2 CSA O112.4 SERIES-M1977 (R2006), Standards for Wood Adhesives.
- .3 CSA O121-08, Douglas Fir Plywood.
- .4 CSA O141-05, Softwood Lumber.
- .5 CSA O151-14, Canadian Softwood Plywood.
- .6 CSA O153-M1980 (R2014), Poplar Plywood.

.4 American National Standards Institute (ANSI)
- .1 ANSI/NPA A208.1-09, Particleboard.
- .2 ANSI/NPA A208.2-09, Medium Density Fiberboard (MDF) for Interior Applications.
- .3 ANSI/HPVA HP-1 10, Standard for Hardwood and Decorative Plywood.

.5 ASTM International
- .1 ASTM E 1333-14, Standard Test Method for Determining Formaldehyde Concentrations in Air and Emission Rates From Wood Products Using A Large Chamber.
- .2 ASTM D 2832-92 (2016), Standard Guide for Determining Volatile and Nonvolatile Content of Paint and Related Coatings.
- .3 ASTM D 5116-06, Standard Guide For Small-Scale Environmental Chamber Determinations of Organic Emissions From Indoor Materials/Products.

.6 Forest Stewardship Council (FSC)
- .1 FSC-STD-01-001-2004, FSC Principle and Criteria for Forest Stewardship.
- .2 FSC-STD-20-002-2004, Structure and Content of Forest Stewardship Standards V2-1.

.7 Green Seal Environmental Standards (GS)
- .1 GS-11-2015, 2nd Edition, Paints and Coatings.
- .2 GS-36-2013, Commercial Adhesives.

.8 Health Canada / Workplace Hazardous Materials Information System (WHMIS)
- .1 Material Safety Data Sheets (MSDS)

.9 National Electrical Manufacturers Association (NEMA)
- .1 ANSI/NEMA LD-3-05, High-Pressure Decorative Laminates (HPDL).

.10 National Hardwood Lumber Association (NHLA)
- .1 Rules for the Measurement and Inspection of Hardwood and Cypress 1998.

.11 National Lumber Grades Authority (NLGA)
- .1 Standard Grading Rules for Canadian Lumber 2003(R2007).

.12 South Coast Air Quality Management District (SCAQMD), California State, Regulation XI. Source

Specific Standards
.1 SCAQMD Rule 1113-A2011, Architectural Coatings.
.2 SCAQMD Rule 1168-A2005, Adhesives and Sealants Applications.

1.3 SUBMITTALS

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

.2 Product Data:
.1 Submit manufacturer's instructions, printed product literature and data sheets for architectural woodwork and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Shop Drawings:
.1 Indicate details of construction, profiles, jointing, fastening and other related details.
.1 Scales: profiles half-full sized, details quarter-full sized.
.2 Indicate materials, thicknesses, finishes and hardware.
.3 Indicate locations of service outlets in casework, typical and special installation conditions, and connections, attachments, anchorage and location of exposed fastenings.

.4 Samples:
.1 Submit for review and acceptance of each unit.
.2 Samples will be returned for inclusion into work.
.3 Submit duplicate samples of solid surface.

.5 Certifications: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.6 Sustainable Design Submittals:
.1 Construction Waste Management:
.1 Submit project Waste Management Plan highlighting recycling and salvage requirements.
.2 Submit calculations on end-of-project recycling rates, salvage rates, and landfill rates demonstrating amount of construction wastes that are recycled or salvaged.
.2 Recycled Content:
.1 Submit listing of recycled content products used, including details of required percentages or recycled content materials and products, showing their costs and percentages of post-consumer and post-industrial content, and total cost of materials for project.
.3 Regional Materials: submit evidence that project incorporates required percentage 20% of regional materials and products, showing their cost, distance from project to furthest site of extraction or manufacture, and total cost of materials for project.
.4 Certified Wood:
.1 Submit listing of wood products and materials used, produced from wood obtained from forests certified by FSC Accredited Certification Body in accordance with FSC-STD-01-001.
.2 Submit manufacturer's FSC Chain-of-Custody Certificate number.
.5 Low-Emitting Materials:
.1 Submit listing of adhesives and sealants and paints and coatings used in building, comply with VOC and chemical component limits or restrictions requirements.
.2 Submit listing of composite wood products used in building, stating that they contain no added urea-formaldehyde resins, and laminate adhesives used in building, stating that they contain no urea-formaldehyde.

1.4 QUALITY ASSURANCE

.1 Lumber by grade stamp of an agency certified by Canadian Lumber Standards Accreditation Board.

.2 Plywood, particleboard, OSB and wood based composite panels to CSA and ANSI standards.

.3 Mock-ups:

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

.1 Shop prepare one base cabinet unit, wall cabinet, counter top and shelving unit complete with hardware and shop applied finishes, and install where directed by Departmental Representative.

.2 Allow 72 hours for inspection of mock-up by Departmental Representative before proceeding with Work.

.3 When accepted, mock-up will demonstrate minimum standard for Work.

.4 Do not proceed with work prior to receipt of written acceptance of mock-up by Departmental Representative.

.5 Mock-up may remain as part of finished work.

1.5 DELIVERY, STORAGE AND HANDLING

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

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

.1 Protect millwork against dampness and damage during and after delivery.

.2 Store millwork in ventilated areas, protected from extreme changes of temperature or humidity.

.3 Storage and Handling Requirements:

.1 Store materials off ground in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect architectural woodwork from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

.4 Develop Construction Waste Management Plan related to Work

.5 Packaging Waste Management: remove for reuse by manufacturer of pallets, crates, padding, and packaging materials as specified in Construction Waste Management Plan in accordance with Section 01 74 19 - Waste Management and Disposal.

1.6 COORDINATION & VERIFICATION

.1 Verify all dimensions & existing conditions on job site prior to all shop fabrication and work on site. Where major discrepancies occur, alert Departmental Representative.

.2 Coordinate work of this section with that of wall, electrical and mechanical sections where millwork interfaces with drywall partitions, plumbing, electrical outlets, etc.

.3 It shall be the responsibility of this section to verify the dimensions and installation details for all Departmental Representative supplied equipment and furnishings requiring cut-outs, adaptations and interfacing with millwork items.

1.7 INSPECTION

.1 Architectural woodwork shall be manufactured and/or installed to AWMAC’s standards (Custom Grade) and shall be subject to an inspection at the plant and/or site, by an appointed inspector approved by the BC Chapter of AWMAC. Such inspection costs shall be included in the tender price for this project. Shop drawings shall be submitted for review or approval before any work is commenced. Where it is deemed necessary by the Departmental Representative, a sample cabinet (consisting of a minimum of 1 drawer, 1 door, showing precisely the materials, hardware and the type of construction the manufacturer intends to use), shall be submitted for inspection.

.2 Any work which does not meet AWMAC’s standards as specified, shall be replaced by this Section at no additional cost to the Department Representative and to the satisfaction of the Departmental Representative and the inspector.

1.8 GUARANTEE

.1 This section shall furnish the Departmental Representative with a two (2) year M.M.A.B.C. (The BC Chapter of AWMAC) Guarantee Certificate or an equivalent maintenance bond, to the full value of the architectural woodwork sub-contract, certifying that the architectural woodwork supplied will be in accordance with the Standards incorporated in the AWMAC's standards, latest edition.

.2 The Guarantee shall cover replacing and refinishing to make good any defects in architectural woodwork due to faulty workmanship or defective materials supplied by this Section, which appear during a two (2) year period following the substantial completion of the Project.

2.0 PRODUCTS

2.1 INTERIOR FINISH MATERIAL AND COLOUR SCHEDULE

.1 This schedule is attached in the appendix and may list specific manufacturers related to patterns and colours upon which the colour scheme for the project is based.

.2 The following material specifications, which are prescriptive in nature, are presented in order to establish a quality of product upon which a price can be tendered.

.3 The Departmental Representative will consider substitute Products which meet or exceed the properties of the specified Product and are similar in material, construction, thickness, colour, texture, and overall quality, provided that proposals are submitted to the Departmental Representative complete with samples and whatever other data the Departmental Representative may require in order to evaluate the proposed substitute Product. If the Departmental Representative approves the proposed substitute Product, the Contractor will have the option of providing Product listed in the Finish schedule or an approved alternative.

2.2 MATERIALS

.1 Softwood lumber: unless specified otherwise, S4S, moisture content 15% or less in accordance with following standards:
- .1 CSA O141.
- .2 NLGA Standard Grading Rules for Canadian Lumber.
- .3 AWMAC custom grade, moisture content as specified.
- .4 Forestry Stewardship Council (FSC) certified.

.2 Machine stress-rated lumber is acceptable for all purposes.

.3 Hardwood lumber: moisture content 15% or less in accordance with following standards:
- .1 National Hardwood Lumber Association (NHLA).
- .2 AWMAC custom grade, moisture content as specified.

.4 Douglas fir plywood (DFP): to CSA O121, standard construction, FSC certified.
- .1 Plywood resin to contain no added urea-formaldehyde.

.5 Canadian softwood plywood (CSP): to CSA O151, standard construction, FSC certified.
- .1 Plywood resin to contain no added urea-formaldehyde.

.6 Hardwood plywood: to ANSI/HPVA HP-1, FSC certified.
- .1 Plywood resin to contain no added urea-formaldehyde.

.7 Poplar plywood (PP): to CSA 0153, standard construction, FSC certified.
- .1 Plywood resin to contain no added urea-formaldehyde.

.8 Hardboard:
- .1 To CAN/CGSB-11.3, FSC certified.
- .2 Hardboard resin to contain no added urea-formaldehyde.

.9 MDF (medium density fibreboard) core: to ANSI/NPA A208.2, Grade Custom, density 769 kg/m², FSC certified.
- .1 Medium density fibreboard performance requirements to: ANSI/NPA A208.2.
- .2 MDF resin to contain no added urea-formaldehyde.

.10 Nails and staples: to CSA B111.

.11 Wood screws: stainless steel, type and size to suit application.

.12 Splines: metal.

.13 Sealant: in accordance with Section 07 92 00 - Joint Sealants.
- .1 Sealants: VOC limit 250 g/L maximum to SCAQMD Rule 1168.

2.3 MANUFACTURED UNITS

.1 Casework with Plastic Laminate Finish:
- .1 AWMAC Quality Grade: Custom. Locations as noted on the drawings.
- .2 Construction: Conform to Section 400 of the manual for Flush Overlay Casework. Close voids and cavities at inside corners and behind end fillers of upper cabinets.
- .3 Exposed Parts: Plastic laminate on MDF, U.N.O.
- .4 Semi-Exposed Parts: Plastic Laminate on MDF core. Color, pattern and finish to match exposed parts, U.N.O.
- .5 Interior Shelving, U.N.O: 19mm melamine with finished edges. All interior gables and interior backing to be melamine on closed units. All doors, drawers would be plastic laminate on both sides; on open units, all interior to be plastic laminate.
- .6 Edge Banding, U.N.O.: matching laminate face material finish in colour, pattern, and finish as per AWMAC Standard.
- .7 Concealed Parts: backer to manufacturer's option.
- .8 Grain direction refer to drawings.

2.4 CASEWORK HARDWARE

.1 Hinges: fully concealed, all metal construction, 3-way adjustment, one (1) hinge in each pair to be spring activated, 170 degree opening.

.2 Door and Drawer Recessed Pulls: Matt Chrome Finish, 160mm c/c, 166 x 40x 14mm. Acceptable Product: Richelieu 616748160-174 or equivalent.

.3 Drawer Slides: Full extension with 25mm over travel, side mounting, telescopic action on ball bearings, 100-lb class, chrome finish, lift or lever disconnect for drawer removal, non-handed. Acceptable products: Accuride, Knape & Vogt, Roll-it or equivalent.

.4 Shelf Supports: Adjustable Aluminum Shelf Standards and Supports, 17-gauge aluminum, 13mm on centers adjustment increments. Electro-plated aluminum finish. Recess standards in gables. Acceptable product: Richelieu Knape & Vogt #255 standards and #256 supports or equivalent.

.5 Finish to all cabinet hardware-Satin chrome finish unless otherwise specified.

.6 Provide colour-coordinated plastic screw caps on ctsk screws.

.7 All millwork hardware as required to complete work.

2.5 PLASTIC LAMINATE

.1 Plastic Laminate on MDF core U.N.O.

.2 Post-form worktop for counter with plastic laminate, conform to AWI/AWMAC AWMAC's standards. Refer to drawings.

.3 Backer sheets to be applied to reverse side of all laminated work surfaces.

.4 Edge Treatment: Same as laminate cladding on horizontal surfaces, U.N.O.

.5 Core Materials: 19mm MDF generally. 25mm thick for longer span as per AWMAC requirement.

2.6 COUNTERTOPS (SINK & VANITY) & BACK/SIDE SPLASHES:

.1 Post-formed (6.35mm / ¼" roundover) plastic laminate on plywood core.

.2 Core Materials: 19mm minimum non-telegraphing plywood at countertops with sink or other plumbing cut-outs. 25mm thick for longer span as per AWMAC requirement.

.3 Post-formed back/side splashes to all countertops.

.4 Caulking at all edges.

2.7 CLOSET COAT ROD

.1 Closet Coat Rod: heavy duty solid wood, 33mm diameter minimum with metal screwed-in rod support.

.2 Location: All closets, including existing and new.

2.8 FABRICATION

.1 Fabricate material in accordance with manufacturer's Fabrication Guide.

.2 Fabricate countertops, sinks, and splash of 13 mm thick material unless otherwise indicated.

.3 Cut and finish component edges with clean, sharp returns. Finished edges shall have a 1.6 mm radius.

.4 Integral Sinks shall be formed integrally with countertops.

.5 Cutouts for sinks shall be smooth and uniform without saw marks. The top and bottom of openings shall be finished smooth. Maintain minimum 6 mm radius for sink cutouts.

.6 Cutouts for accessories shall be smooth and uniform without saw marks. The top and bottom of openings shall be finished smooth.

.7 Set nails and countersink screws apply stained wood filler to indentations, sand smooth and leave ready to receive finish.

.8 Provide cutouts for plumbing fixtures, inserts, appliances, outlet boxes and other fixtures.

.9 Shop assemble work for delivery to site in size easily handled and to ensure passage through building openings.

3.0 EXECUTION

3.1 EXAMINATION

.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 architectural woodwork to AWMAC's standards.

.2 Install vanity in accordance with manufacturer's instructions installation guidelines and recommendations.

.3 Install prefinished millwork at locations shown on drawings.
.1 Position accurately, level, plumb straight.

.4 Form joints using manufacturer's approved adhesive, with joints inconspicuous in finished work.

.5 Cure countertops for 24 hours, minimum, before exposure to moisture or pressure.

.6 Corner joints: Form 3 mm-wide joints, sealed with manufacturer’s color-matching silicone sealant.

.7 Scribe and cut as required to fit abutting walls and to fit properly into recesses and to accommodate piping, columns, fixtures, outlets or other projecting, intersecting or penetrating objects.

.8 Provide post-formed backsplashes and end splashes as shown on the Drawings.

.9 Field joints shall be hard seamed unless otherwise specified.

.10 Tops: Anchor securely to base units and other support systems as indicated. Caulk space between back-splash and wall with specified sealant.

.11 Install countertops with no more than 3mm in 2400mm (1/8 inch in 96-inch) sag, bow, or other variation from a straight line. Use draw bolts in countertop joints.

.12 Screws should not come in contact with solid surface material, as this may cause cracking of countertop.

.13 Apply water resistant building paper over wood framing members in contact with masonry or cementitious construction.

.14 Fasten and anchor millwork securely.

.15 At junction of counter back splash and adjacent wall finish, apply small bead of sealant in accordance with Section 07 92 00 - Joint Sealants.

3.3 CLEANING

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

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.
.1 Clean millwork and cabinet work inside cupboards and drawers and outside surfaces.
.2 Remove excess glue from surfaces.
.3 Solid surface to be cleaned as per manufacturer’s instructions.

.3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 19 - Waste Management and Disposal.
.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.4 PROTECTION

.1 Protect millwork from damage until final inspection.

.2 Protect installed products and components from damage during construction.

.3 Repair damage to adjacent materials caused by architectural woodwork installation.

3.5 SCHEDULE

.1 Plastic Laminate: Refer to Interior Finish Material and Colour Schedule.

END OF SECTION 06 40 00

1.0 GENERAL

1.1 RELATED REQUIREMENTS

.1 Gypsum Board Assemblies Section 09 21 16

.2 Non-Structural Metal Framing Section 09 22 16

1.2 REFERENCES

.1 American Society for Testing and Materials International (ASTM)
- .1 ASTM C 553-02, Specification for Mineral Fibre Blanket Thermal Insulation for Commercial and Industrial Applications.
- .2 ASTM C 665-01e1, Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing.
- .3 ASTM C 1320-05, Standard Practice for Installation of Mineral Fiber Batt and Blanket Thermal Insulation for Light Frame Construction.

.2 Canadian Gas Association (CGA)
- .1 CAN/CGA-B149.1-05, Natural Gas and Propane Installation Code Handbook.
- .2 CAN/CGA-B149.2-05, Propane Storage and Handling Code.

.3 Canadian Standards Association (CSA International)
- .1 CSA B111-1974 (R2003), Wire Nails, Spikes and Staples.

.4 Underwriters Laboratories of Canada (ULC)
- .1 CAN/ULC-S604-M1991, Type A Chimneys.
- .2 CAN/ULC-S702-1997, Standard for Mineral Fibre Insulation

1.3 SUBMITTALS

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

.2 Product Data:
- .1 Submit manufacturer's printed product literature, specifications and data sheet in accordance with Section 01 33 00 - Submittal Procedures.

.2 Manufacturer's Instructions:
- .1 Submit manufacturer's installation instructions.

1.4 QUALITY ASSURANCE

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

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

.3 Convene pre-installation meeting one week prior to beginning work of this Section and on-site installations in accordance with Section 01 32 16.07 - Construction Progress Schedule-Bar (GANTT) Chart.
- .1 Verify project requirements.
- .2 Review installation and substrate conditions.
- .3 Co-ordinate with other building sub-trades.

.4 Review manufacturer's installation instructions and warranty requirements.

.4 Health and Safety Requirements: do construction occupational health and safety in accordance with Section 01 35 33 - Health and Safety Requirements.

1.5 WASTE MANAGEMENT & DISPOSAL

.1 Separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management And Disposal.

.2 Remove from site and dispose of packaging materials at appropriate recycling facilities.

.3 Collect and separate for disposal packaging material for recycling in accordance with Waste Management Plan.

2.0 PRODUCTS

2.1 INSULATION

.1 Acoustic Batt & blanket mineral wool: Comply Type 1 CAN/ULC-5702-09, Type 1 for ASTM C665, Comply ASTM C553.

.1 Fire Performance:

CAN4 S114	Test for Non-Combustibility	Non-Combustible
ASTM E 136	Behavior of Materials at 750°C (1382°F)	Non-Combustible
CAN/ULC S102	Surface Burning Characteristics	Flame Spread = 0 Smoke Developed = 0
ASTM E84 (UL 723)	Surface Burning Characteristics	Flame Spread = 0 Smoke Developed = 0
CAN/ULC S129	Smolder Resistance	0.09%

.2 Acoustical Performance:

ASTM E 90	Airborne Sound Transmission	Tested
ASTM # 413	Rating Sound Insulation	Tested
ASTM C 423	Sound Absorption coefficients	Tested
ASTM E 1050	Impedance and Absorption of Acoustical Materials	Tested

.3 Density: 45 kg/m^3 minimum

2.2 ACCESSORIES

.1 Insulation clips:

.1 Impale type, perforated 50 x 50 mm cold rolled carbon steel 0.8 mm thick, adhesive back, spindle of 2.5 mm diameter annealed steel, length to suit insulation, 25 mm diameter washers of self-locking type.

.2 Nails: galvanized steel, length to suit insulation plus 25 mm, to CSA B111.

.3 Staples: 12 mm minimum leg.

.4 Tape: as recommended by manufacturer.

3.0 EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written data, including product technical bulletins, product catalogue installation instructions, product carton installation instructions, and data sheets.

3.2 INSULATION INSTALLATION

.1 Install insulation to maintain continuity of thermal protection to building elements and spaces.

.2 Fit insulation closely around electrical boxes, pipes, ducts, frames and other objects in or passing through insulation.

.3 Do not compress insulation to fit into spaces.

.4 Keep insulation minimum 75 mm from heat emitting devices such as recessed light fixtures, and minimum 50 mm from CAN/CGA-B149.1 and CAN/CGA-B149.2 Type B and L vents.

.5 Do not enclose insulation until it has been reviewed and approved by Departmental Representative.

3.3 CLEANING

.1 Upon completion of installation, remove surplus materials, rubbish, tools and equipment barriers. security devices.

END OF SECTION 07 21 16

1 .0 GENERAL

1.1 RELATED REQUIREMENTS

.1 Architectural Woodwork Section 06 40 00

.2 Gypsum Board Assemblies Section 09 21 16

1.2 REFERENCES

.1 American Society for Testing and Materials International, (ASTM)
- .1 ASTM C 919- 02, Standard Practice for Use of Sealants in Acoustical Applications.

.2 Canadian General Standards Board (CGSB)
- .1 CGSB 19-GP-5M- 1984 , Sealing Compound, One Component, Acrylic Base, Solvent Curing (Issue of 1976 reaffirmed, incorporating Amendment No. 1).
- .2 CAN/CGSB-19.13- M87, Sealing Compound, One-component, Elastomeric, Chemical Curing.
- .3 CGSB 19-GP-14M- 1984, Sealing Compound, One Component, Butyl-Polyisobutylene Polymer Base, Solvent Curing (Reaffirmation of April 1976).
- .4 CAN/CGSB-19.17- M90, One-Component Acrylic Emulsion Base Sealing Compound.
- .5 CAN/CGSB-19.24- M90, Multi-component, Chemical Curing Sealing Compound.

.3 Department of Justice Canada (Jus)
- .1 Canadian Environmental Protection Act, 1999 (CEPA).

.4 General Services Administration (GSA) - Federal Specifications (FS)
- .1 FS-SS-S-200- E (2)1993 , Sealants, Joint, Two-Component, Jet-Blast-Resistant, Cold Applied, for Portland Cement Concrete Pavement.

.5 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
- .1 Material Safety Data Sheets (MSDS).

.6 Transport Canada (TC)
- .1 Transportation of Dangerous Goods Act, 1992 (TDGA).

1.3 SUBMITTALS

.1 Submit product data in accordance with Section 01 33 00 - Submittal Procedures.

.2 Manufacturer's product to describe.
- .1 Caulking compound.
- .2 Primers.
- .3 Sealing compound, each type, including compatibility when different sealants are in contact with each other.

.3 Submit samples in accordance with Section 01 33 00 - Submittal Procedures.

.4 Submit duplicate samples of each type of material and colour.

.5 Cured samples of exposed sealants for each color where required to match adjacent material.

.6 Submit manufacturer's instructions in accordance with Section 01 33 00 - Submittal Procedures.
- .1 Instructions to include installation instructions for each product used.

1.4 QUALITY ASSURANCE / MOCK-UPS

.1 Construct mock-up in accordance with Section 01 45 00 - Quality Control.

.2 Construct mock-up to show location, size, shape and depth of joints complete with back-up material, primer, caulking and sealant.

.3 Mock-up will be used:

.1 To judge workmanship, substrate preparation, operation of equipment and material application.

.4 Location to be decided with Departmental Representative.

.5 Allow 24 hours for inspection of mock-up by Departmental Representative before proceeding with sealant work.

.6 When accepted, mock-up will demonstrate minimum standard of quality required for this Work. Approved mock-up may remain as part of finished Work.

1.5 DELIVERY, STORAGE & HANDLING

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

.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.

.3 Upon completion of Work, after cleaning is carried out.

1.6 WASTE MANAGEMENT AND DISPOSAL

.1 Separate waste materials for recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management And Disposal.

.2 Remove from site and dispose of packaging materials at appropriate recycling facilities.

.3 Collect and separate for disposal paper and corrugated cardboard packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.

.4 Place materials defined as hazardous or toxic in designated containers.

.5 Handle and dispose of hazardous materials in accordance with the CEPA, TDGA, Regional and Municipal regulations.

.6 Unused sealant material must not be disposed of into sewer system, into streams, lakes, onto ground or in other location where it will pose health or environmental hazard.

.7 Divert unused joint sealing material from landfill to official hazardous material collections site approved by Departmental Representative.

.8 Empty plastic joint sealer containers are not recyclable. Do not dispose of empty containers with plastic materials destined for recycling.

.9 Fold up metal banding, flatten, and place in designated area for recycling.

1.7 SITE CONDITIONS

.1 Environmental Limitations:

.1 Do not proceed with installation of joint sealants under following conditions:

.1 When ambient and substrate temperature conditions are outside limits permitted by joint sealant manufacturer or are below 4.4 degrees C.

.2 When joint substrates are wet.

.2 Joint-Width Conditions:

.1 Do not proceed with installation of joint sealants where joint widths are less than those allowed by joint sealant manufacturer for applications indicated.

.3 Joint-Substrate Conditions:

.1 Do not proceed with installation of joint sealants until contaminants capable of interfering with adhesion are removed from joint substrates.

1.8 ENVIRONMENTAL REQUIREMENTS

.1 Comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage, and disposal of hazardous materials; and regarding labelling and provision of Material Safety Data Sheets (MSDS) acceptable to Labour Canada.

.2 Conform to manufacturer's recommended temperatures, relative humidity, and substrate moisture content for application and curing of sealants including special conditions governing use.

.3 Ventilate area of work as directed by Departmental Representative by use of approved portable supply and exhaust fans.

2.0 PRODUCTS

2.1 SEALANT MATERIALS

.1 Do not use caulking that emits strong odours, contains toxic chemicals or is not certified as mould resistant in air handling units.

.2 When low toxicity caulks are not possible, confine usage to areas which offgas to exterior, are contained behind air barriers, or are applied several months before occupancy to maximize offgas time.

.3 Where sealants are qualified with primers use only these primers.

.4 Standard: For interior and exterior work unless otherwise specified, ensure compatibility of sealants being used and other materials in contact with them, meet LEED® requirement VOC level of 250 g/L for architectural sealant, and conform to the latest editions of the specifications summarized below:

2.2 SEALANT TYPE

.1 Type 4: Structural glazing sealant: two part, neutral cure, elastomeric silicone sealant conforming to ASTM C920, Type S, NS, Class 25 standard; designed for joint dynamic movement 25%.

.2 Type 5: One component elastomeric chemical cure silicone: for joints minimum 6 mm x 6 mm and maximum as directed by product manufacturer; conform to CAN/CGSB-2-19.13-M87 (TT 002230C Type 11, Class A) standard; one component silicone base. (Consultant’s written approval shall be required prior to use of this sealant).

.3 Type 6: Acrylic sealant: conform to CGSB-19-GP-5M.

.4 Type 8: Partition sealant: acrylic sealant conforming to CGSB 19-GP-5M standard, for exposed to view sealing work; provide around electrical boxes, phone plugs, and other penetrations in partitions scheduled for acoustic separation.

2.3 SEALANT SELECTION

.1 Structural glazing: Sealant type 4.

.2 Perimeters of interior frames: Sealant type: 6.

.3 Exposed interior control joints in drywall: Sealant type: 8.

2.4 JOINT CLEANER

.1 Non-corrosive and non-staining type, compatible with joint forming materials and sealant recommended by sealant manufacturer.

.2 Primer: as recommended by manufacturer.

3.0 EXECUTION

3.1 PROTECTION

.1 Protect installed Work of other trades from staining or contamination.

3.2 SURFACE PREPARATION

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

.2 Clean bonding joint surfaces of harmful matter substances including dust, rust, oil grease, and other matter 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 been performed to ensure compatibility of materials. Remove coatings as required.

.4 Ensure joint surfaces are dry and frost free.

.5 Prepare surfaces in accordance with manufacturer's directions.

3.3 PRIMING

.1 Where necessary to prevent staining, mask adjacent surfaces prior to priming and caulking.

.2 Prime sides of joints in accordance with sealant manufacturer's instructions immediately prior to caulking.

3.4 BACKUP MATERIAL

.1 Apply bond breaker tape where required to manufacturer's instructions.

.2 Install joint filler to achieve correct joint depth and shape, with approximately 30% compression.

3.5 MIXING

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

3.6 APPLICATION

.1 Sealant.

.1 Apply sealant in accordance with manufacturer's written instructions.

.2 Mask edges of joint where irregular surface or sensitive joint border exists to provide neat joint.

.3 Apply sealant in continuous beads.

.4 Apply sealant using gun with proper size nozzle.

.5 Use sufficient pressure to fill voids and joints solid.

.6 Form surface of sealant with full bead, smooth, free from ridges, wrinkles, sags, air pockets, embedded impurities.

.7 Tool exposed surfaces before skinning begins to give slightly concave shape.

.8 Remove excess compound promptly as work progresses and upon completion.

.2 Curing.

.1 Cure sealants in accordance with sealant manufacturer's instructions.

.2 Do not cover up sealants until proper curing has taken place.

.3 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.

3.7 CLEANING

.1 Clean adjacent surfaces immediately and leave work clean and neat. Remove excess sealant and droppings using recommended cleaners as work progresses. Remove masking after tooling of joints.

END OF SECTION 07 92 00

1.0 GENERAL

1.1 RELATED REQUIREMENTS

.1	Rough Carpentry for Minor Works	Section 06 08 99
.2	Finish Carpentry	Section 06 20 00
.3	Painting	Section 09 91 23

1.2 REFERENCES

.1 Architectural Woodwork Manufacturers Association of Canada (AWMAC).
- .1 North America Architectural Woodwork Standards (NAAWS), latest edition.

.2 Canadian General Standards Board (CGSB).
- .1 CAN/CGSB-71.19-M88, Adhesive, Contact, Sprayable.
- .2 CAN/CGSB-71.20-M88, Adhesive, Contact, Brushable.

.3 Canadian Standards Association (CSA International).
- .1 CSA A440.2-98, Energy Performance of Windows and Other Fenestration Systems.
- .2 CSA O115-M1982(R2001), Hardwood and Decorative Plywood.
- .3 CAN/CSA O132.2 Series-90 (R1998), Wood Flush Doors.
- .4 CAN/CSA-O132.5-M1992 (R1998), Stile and Rail Wood Doors.
- .5 CAN/CSA-Z808-96, A Sustainable Forest Management System: Guidance Document.
- .6 CSA Certification Program for Windows and Doors 00.

.4 Environmental Choice Program (ECP).
- .1 CCD-045-92, Sealants and Caulking Compounds.
- .2 CCD-046-92, Adhesives.

.5 National Fire Protection Association (NFPA).
- .1 NFPA 80-1999, Standard for Fire Doors and Fire Windows.
- .2 NFPA 252-1999, Standard Method of Fire Tests of Door Assemblies.

.6 Underwriters' Laboratories of Canada (ULC).
- .1 CAN-4S104M-80 (R1985), Fire Tests of Door Assemblies.
- .2 CAN4-S105M-85 (R1992), Fire Door Frames Meeting the Performance Required by CAN4-S104.

1.3 SUBMITTALS

.1 Product Data:
- .1 Submit manufacturer's printed product literature, specifications and data sheet in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit two copies of WHMIS MSDS - Material Safety Data Sheets in accordance with Section 01 33 00 - Submittal Procedures. Indicate VOC content:
  - .1 For caulking materials during application and curing.
  - .2 For door materials and adhesives.
- .3 Submit FSC Chain of Custody Certificate.

2 Shop Drawings:
- .1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Indicate door types and cutouts for lights and louvres, sizes, core construction, transom

panel construction and cutouts.

1.4 SAMPLES

.1 Submit samples in accordance with Section 01 33 00 - Submittal Procedures.

.2 Submit one 300 x 300 mm corner sample of each type wood door.

.3 Show door construction, core, detail and faces.

.4 Manufacturer's Instructions:

.1 Submit manufacturer's installation instructions.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Storage and Protection:

.1 Protect doors from dampness. Arrange for delivery after work causing abnormal humidity has been completed.

.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. Wrap doors.

.4 Store doors away from direct sunlight.

1.6 WASTE MANAGEMENT AND DISPOSAL

.1 Remove from site and dispose of packaging materials at appropriate recycling facilities.

.2 Dispose of corrugated cardboard polystyrene plastic packaging material in appropriate on-site bin for recycling in accordance with site waste management program.

.3 Unused or damaged glazing materials are not recyclable and must not be diverted to municipal recycling programs.

.4 Divert unused adhesive material from landfill to official hazardous material collections site approved by Departmental Representative.

.5 Do not dispose of unused paint materials into sewer systems, into lakes, streams, onto ground or in locations where it will pose health or environmental hazard.

1.7 GUARANTEE

.1 This section shall furnish the Departmental Representative with a two (2) year M.M.A.B.C. (The BC Chapter of AWMAC) Guarantee Certificate or an equivalent maintenance bond, to the full value of the architectural woodwork sub-contract, certifying that the architectural woodwork supplied will be in accordance with the Standards incorporated in the AWMAC’s standards, latest edition.

.2 The Guarantee shall cover replacing and refinishing to make good any defects in architectural woodwork due to faulty workmanship or defective materials supplied by this Section, which appear during a two (2) year period following the substantial completion of the Project.

2.0 PRODUCTS

2.1 WOOD FLUSH DOORS

.1 Solid core: to CAN/CSA-O132.2.1.

.1 Construction:

.1 Core: Agfiber particleboard to ANS1 A280.1 LD7

.2 Face Panels as scheduled:
.1 Paint grade MDO

.2 Adhesive: Type I (waterproof) no urea formaldehyde for all doors.

.3 Stiles & Rail:
.1 Standard: AWMAC Custom Grade
.2 Style to match existing doors

.4 Environmental:
.1 All wood in door FSC certified or FSC controlled
.2 Manufactured with pre-consumer recycled material

2.2 FABRICATION

.1 Prepare doors for louvres and glazing. Provide to match face veneer glazing stops with mitred corners.

.2 Bevel vertical edges of single acting doors 3 mm in 50 mm on lock side and 1.5 mm in 50 mm on hinge side.

.3 Radius vertical edges of double acting doors to 60 mm radius.

3.0 EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 INSTALLATION

.1 Unwrap and protect doors in accordance with CAN/CSA-O132.2 Series, Appendix A.

.2 Install doors and hardware in accordance with manufacturer's printed instructions and CAN/CSA-O132.2 Series, Appendix A.

.3 Adjust hardware for correct function.

.4 Install stops.

.5 Secure transom and side panels by means of stops concealed fasteners or countersunk screws concealed by means of wood plugs matching panel in grain and colour.

3.3 ADJUSTMENT

.1 Re-adjust doors and hardware just prior to completion of building to function freely and properly.

3.4 CLEANING

.1 Perform cleaning as soon as possible after installation to remove construction and accumulated environmental dirt.

.2 Remove traces of primer, caulking; clean doors and frames.

.3 On completion of installation, remove surplus materials, rubbish, tools and equipment barriers.

END OF SECTION 08 14 16

ROOM FINISH SCHEDULE

				WALLS					REMARKS
NO.	ROOM NAME	FLOOR	BASE	WEST WALL	NORTH WALL	EAST WALL	SOUTH WALL	CEILING	
101	New Living Room	EX	EX/WB	PT	PT	PT	PT	GWB	
102	New Bath Room	SV/PRT-1	WB	PT/PRT-2	PT	PT/PRT-2	PRT-2	GWB	
103	Ex. Storage Room	EX	EX	EX	PT	EX	EX	EX	
104	New Kitchen	SV	WB	PT	PT	PT	PT	GWB	
105	New Bedroom	EX	EX	PT	PT	PT	PT	GWB	
106	New Bedroom	EX	EX	PT	PT	PT	PT	GWB	
107	New Laundry Closet	SV	WB	PT	PT	PT	PT	GWB	
209	New Laundry Closet	SV	WB	PT	PT	PT	PT	GWB	

LEGENDS

FLOOR		BASE		WALLS		CEILINGS	
EX	Existing Flooring	EX	Existing Base	EX	Existing Wall	EX	Existing Ceiling
PRT	Porcelain Tile	WB	Wood Base to match EX, painted	PRT	Porcelain Tile	GWB	GWB Ceiling Paint Finish
				PT	Painted		

GENERAL NOTES

.1 Vertical bulkheads/down drops to be finished same as horizontal U.O.N.
.2 Return wall finishes into window frames at jambs and head U.O.N.
.3 Wall finishes to extend down to floor with applied base over.
.4 All exposed services to be painted as adjacent wall U.O.N.
.5 All change of flooring in hallways must extend to the room side of the door frame U.O.N.
.6 Refer to drawing for change of flooring, interior elevation, ceiling design and details.
.7 Make good and level existing slab to receive flooring to meet flooring manufacturer's requirement.
.8 Make goods existing walls to paintable condition prior to applying new painting.
.9 Paint walls and apply wood base to match existing to walls that have been disturbed by construction work.
.10 Replace all existing closet rods as specified.
.11 Paint existing wood base to match new wood base in room where new wood base is installed.

END OF SECTION 09 06 00.13

1.0 GENERAL

1.1 RELATED REQUIREMENTS

.1	Joint Sealants	Section 07 92 00
.2	Non-Structural Metal Framing	Section 09 22 16
.3	Painting	Section 09 91 23

1.2 REFERENCES

.1 Aluminum Association (AA)
- .1 AA DAF 45-03 (R2009), Designation System for Aluminum Finishes.

.2 ASTM International
- .1 ASTM C 475-02 (2007), Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board.
- .2 ASTM C 514-04 (2009e1), Standard Specification for Nails for the Application of Gypsum Board.
- .3 ASTM C 557-03 (2009) e1,Standard Specification for Adhesives for Fastening Gypsum Wallboard to Wood Framing.
- .4 ASTM C 840-08, Standard Specification for Application and Finishing of Gypsum Board.
- .5 ASTM C 954-07, Standard Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs From 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness.
- .6 ASTM C 1002-07, 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.
- .7 ASTM C 1047-09, Standard Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base.
- .8 ASTM C 1280-99, Standard Specification for Application of Gypsum Sheathing.
- .9 ASTM C 1177/C 1177M-08, Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing.
- .10 ASTM C 1178/C 1178M-08, Standard Specification for Glass Mat Water-Resistant Gypsum Backing Board.
- .11 ASTM C 1396/C 1396M-09a, Standard Specification for Gypsum Wallboard.

.3 Association of the Wall and Ceilings Industries International (AWCI)
- .1 AWCI Levels of Gypsum Board Finish-97.

.4 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.

.5 Underwriters' Laboratories of Canada (ULC)
- .1 CAN/ULC-S102-07, Standard Method of Test of Surface Burning Characteristics of Building Materials and Assemblies.

1.3 SUBMITTALS

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

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for gypsum board assemblies and include product characteristics, performance criteria, physical size, finish and limitations.

1.4 DELIVERY, STORAGE AND HANDLING

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

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

.3 Storage and Handling Requirements:

.1 Store gypsum board assemblies materials level off ground 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.

.3 Protect from weather, elements and damage from construction operations.

.4 Handle gypsum boards to prevent damage to edges, ends or surfaces.

.5 Protect prefinished aluminum surfaces with wrapping. Do not use adhesive papers or sprayed coatings which bond when exposed to sunlight or weather.

.6 Replace defective or damaged materials with new.

.4 Develop Construction Waste Management Plan related to Work of this Section.

.5 Packaging Waste Management: remove for reuse of pallets, crates, padding, and packaging materials as specified in Construction Waste Management Plan in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

1.5 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 minimum after 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.

2.0 PRODUCTS

2.1 MATERIALS

.1 Standard board: to ASTM C 1396/C 1396M regular, 12.7mm and 15.9 mm thick and Type X, 12.7 mm and 15.9 mm thick, 1200 mm wide x maximum practical length, ends square cut, edges tapered.

.2 Gypsum sheathing board: to ASTM C 1396/C 1396M, regular, 12.7mm and 15.9 mm thick and Type X, 12.7mm and 15.9 mm thick, 1200 mm wide x maximum practical length.

.3 Backing board and coreboard: to ASTM C 1396/C 1396M regular, 127mm 15.9 mm thick and Type X, 12.7mm and 15.9 mm thick, bevelled edges.

.4 Water-resistant board: to ASTM C 1396/C 1396M regular, 12.7mm and 15.9 mm thick and Type X,

12.7mm and 15.9mm thick, 1220 mm wide x maximum practical length.

.5 Glass mat water-resistant gypsum backing board: to ASTM C 1178/C 1178M, 12.7 and 15.9 mm thick, 1200 mm wide x maximum practical length.

.6 Resilient clips and drywall furring: 0.5 mm base steel thickness galvanized steel for resilient attachment of gypsum board.

.7 Nails: to ASTM C 514.

.8 Steel drill screws: to ASTM C 1002.

.9 Stud adhesive: to CAN/CGSB-71.25.

.10 Laminating compound: as recommended by manufacturer, asbestos-free.

.11 Casing beads, corner beads, control joints and edge trim: to ASTM C 1047, metal, zinc-coated by hot-dip process, 0.5 mm base thickness, perforated flanges, one piece length per location.

.12 Sealants: in accordance with Section 07 92 00 - Joint Sealants.
- .1 VOC limit 250 g/L maximum to SCAQMD Rule 1168.
- .2 Acoustic sealant: in accordance with Section 07 92 00 - Joint Sealants.

.13 Polyethylene: to CAN/CGSB-51.34, Type 2.

.14 Insulating strip: rubberized, moisture resistant, 3 mm thick cork closed cell neoprene strip, 12 mm wide, with self-sticking permanent adhesive on one face, lengths as required.

.15 Joint compound: to ASTM C 475, asbestos-free.

3.0 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 Do application and finishing of gypsum board to ASTM C 840 except where specified otherwise.

.2 Do application of gypsum sheathing to ASTM C 1280.

.3 Erect hangers and runner channels for suspended gypsum board ceilings to ASTM C 840 except where specified otherwise.

.4 Support light fixtures by providing additional ceiling suspension hangers within 150 mm of each corner and at maximum 600 mm around perimeter of fixture.

.5 Install work level to tolerance of 1:1200.

.6 Frame with furring channels, perimeter of openings for access panels, light fixtures, diffusers, grilles.

.7 Install 19 x 64 mm furring channels parallel to, and at exact locations of steel stud partition header track.

.8 Furr for gypsum board faced vertical bulkheads within and at termination of ceilings.

.9 Furr above suspended ceilings for gypsum board fire and sound stops and to form plenum areas as indicated.

.10 Install wall furring for gypsum board wall finishes to ASTM C 840, except where specified otherwise.

.11 Furr openings and around built-in equipment, cabinets, access panels on four sides. Extend furring into reveals. Check clearances with equipment suppliers.

.12 Furr duct shafts, beams, columns, pipes and exposed services where indicated.

3.3 APPLICATION

.1 Apply gypsum board after bucks, anchors, blocking, sound attenuation, electrical and mechanical work have been approved.

.2 Apply single or double layer gypsum board to wood furring or framing using screw fasteners for first layer, screw fasteners 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 C 840.
  - .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.

.3 Exterior Soffits and Ceilings: install exterior gypsum board perpendicular to supports; stagger end joints over supports. Install with 6 mm gap where boards abut other work.

.4 Apply water-resistant gypsum board where wall tiles to be applied and adjacent to laundry sinks. Apply water-resistant sealant to edges, ends, cut-outs which expose gypsum core and to fastener heads. Do not apply joint treatment on areas to receive tile finish.

.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 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 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 Install insulating strips continuously at edges of gypsum board and casing beads abutting metal window and exterior door frames, to provide thermal break.

.5 Construct control joints of preformed units set in gypsum board facing and supported independently on both sides of joint.

.6 Provide continuous polyethylene dust barrier behind and across control joints.

.7 Locate control joints at changes in substrate construction at approximate 10 m spacing on long corridor runs at approximate 15 m spacing on ceilings.

.8 Install control joints straight and true.

.9 Construct expansion joints as detailed, at building expansion and construction joints. Provide continuous dust barrier.

.10 Install expansion joint straight and true.

.11 Install cornice cap where gypsum board partitions do not extend to ceiling.

.12 Fit cornice cap over partition, secure to partition track with two rows of sheet metal screws staggered at 300 mm on centre.

.13 Splice corners and intersections together and secure to each member with 3 screws.

.14 Install access doors to electrical and mechanical fixtures specified in respective sections.
.1 Rigidly secure frames to furring or framing systems.

.15 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.

.16 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 At wainscot locations and below raised floor. Level 2: embed tape for joints and interior angles in joint compound and apply one separate coat of joint compound over joints, angles, fastener heads and accessories; surfaces free of excess joint compound; tool marks and ridges are acceptable.

.2 At typical wall and ceiling locations. Level 4: 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 edges.

.17 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.

.18 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.

.19 Sand lightly to remove burred edges and other imperfections. Avoid sanding adjacent surface of board.

.20 Completed installation to be smooth, level or plumb, free from waves and other defects and ready for surface finish.

3.5 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.

.1 Leave Work area clean at end of each day.

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

3.6 PROTECTION

.1 Protect installed products and components from damage during construction.

.2 Repair damage to adjacent materials caused by gypsum board assemblies installation.

END OF SECTION 09 21 16

1.0 GENERAL

1.1 RELATED REQUIREMENTS

.1	Rough Carpentry for Minor Works	Section 06 08 99
.2	Blanket Insulation	Section 07 21 16
.3	Joint Sealants	Section 07 92 00
.4	Gypsum Board Assemblies	Section 09 21 16
.5	Non-structural Metal Framing	Section 09 22 16
.6	Ceramic Tiling	Section 09 30 13

1.2 REFERENCES

.1 ANSI 108/A118/A136 – American National Standards for the Installation of Ceramic Tile.

.2 ANSI A108.11 – Installation of Cementitious Backer Units.

.3 ANSI A118.4 – Specifications for Latex Portland Cement Mortar.

.4 ANSI A118.9 – Cementitious Baker Units.

.5 ANSIA136.1 – Organic Adhesives for Installation of Ceramic Tile.

.6 ASTM C1288 – Discrete Non-Asbestos Fiber-Cement Interior Substrate Sheets.

1.3 SUBMITTALS

.1 Submit under provisions of Section 01 33 00 Submittal Procedures.

.2 Product Data: Manufacturer's data sheets on each product to be used, including:
- .1 Preparation instructions and recommendations.
- .2 Storage and handling requirements and recommendations.
- .3 Installation methods.

.3 Verification Samples: For each finish product specified, two samples, minimum size 4 by 6 inches (100 by 150 mm) square, representing actual product, colour, and patterns.

1.4 QUALITY ASSURANCE

.1 Installer Qualifications: Minimum of 2 years' experience with installation of similar products.

1.5 DELIVERY, STORAGE, AND HANDLING

.1 Store products in manufacturer's unopened packaging until ready for installation.

.2 Store boards flat on a smooth level surface. Protect edges and corners from chipping. Store sheets under cover and keep dry prior to installing.

1.6 PROJECT CONDITIONS

.1 Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

1.7 WASTE MANAGEMENT & DISPOSAL

.1 Separate waste materials for recycling in accordance with Section 01 74 19 – Waste Management and Disposal.

1.8 WARRANTY

.1 Product Warranty: limited product warranty against manufacturing defects:

.2 Workmanship Warranty: application limited warranty for 2 years.

2.0 PRODUCTS

2.1 BACKERBOARD

.1 Type: 1/2 inch (13 mm) nominal cement board.

.2 Material shall meet the following building code compliance:
- .1 Non-asbestos fiber-cement to comply with ASTM C1288 and ANSI A118.9
- .2 Board shall meet the building code compliance National Evaluation Report No. NER 405.
- .3 US Department of Housing and Urban Development Materials Release 1268C.
- .4 California DSA PA-019.
- .5 City of Los Angeles, Research Report No. 24862.

2.2 FASTENERS

.1 Wood Framing fasteners
- .1 Wood framing: 1-1/2 inches (32 mm) corrosion resistant (galvanized or stainless steel) roofing nails.
- .2 Wood framing: 1-1/2 inches (32 mm) No. 8 by 0.375 inch (9.5 mm) HD self-drilling, corrosion resistant ribbed wafer head screws.

.2 Metal Framing:
- .1 Metal framing: 1-1/2 inches (32 mm) No. 8 by 0.375 inch (9.5 mm) HD self-drilling, corrosion resistant ribbed wafer head screws.

3.0 EXECUTION

3.1 EXAMINATION

.1 Do not installation until substrates have been properly prepared.

.2 If framing preparation is the responsibility of another installer; notify Architect of unsatisfactory preparation before proceeding.

3.2 WALL FRAMING

.1 Either vertical or horizontal, nominal 2 inches by 4 inches (51 mm by 102 mm) wood framing spaced a maximum of 24 inches (610 mm) on centre with end joints staggered from adjacent courses in both vertical and horizontal applications.

.2 To comply with ANSI A108.11, either vertical or horizontal, nominal 2 inches by 4 inches (51 mm by 102 mm) wood framing spaced a maximum of 16 inches (406 mm)

on centre with end joints staggered from adjacent courses in both vertical and horizontal applications.

.3 Either vertical or horizontal, minimum 20 gauge 3-5/8 inches (92 mm) or 6 inches (152 mm) C-Stud 24 inches (610 mm) maximum on centre metal framing complying with local building codes with end joints staggered from adjacent courses in both vertical and horizontal applications.

.4 Comply with ANSI A108.11, either vertical or horizontal, minimum 20 gauge 3-5/8 inches (92 mm) or 6 inches (152 mm) C-Stud 16 inches (406 mm) maximum on centre metal framing complying with local building codes with end joints staggered from adjacent courses in both vertical and horizontal applications.

.5 Install a water proofing membrane for all shower stalls:
.1 Repair any punctures or tears in vapour barrier prior to the installation of the board.

3.3 PREPARATION

.1 Clean surfaces thoroughly prior to installation.

.2 Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.4 INSTALLATION

.1 Install in accordance with manufacturer's instructions. Install sheets with 1/8 inch (3 mm) gap between sheets.

.2 Place fasteners 8 inches (152 mm) on centre no closer than 3/8 inch (9.5 mm) from board edges and 2 inches (51 mm) from board corners.

.3 Boards shall be placed with a minimum 1/4 inch (6 mm) clearance from the floor surfaces and other horizontal tile termination locations, including above tub edges. This gap shall be free of adhesive and grout and filled with flexible sealant.

.4 Boards shall be placed with a minimum 1/8 inch (3 mm) clearance from wall and cabinet bases, and other horizontal tile termination locations, including above tub edges. This gab shall be free of adhesive and grout and filled with a flexible sealant.

.5 Joints shall be reinforced with 2 inches (51 mm) wide, high-strength, coated, alkali-resistant, glass fiber reinforcing tape embedded into the wet mastic or modified thinset mortar and allowed to dry thoroughly.

.6 For large tiles areas, movement/control joints shall be provided in accordance with ANSI A108, Section AN-3.7 or as indicated on drawings.

.7 Wall tiles complying with ANSI A137.1 are attached to the board with flexible Type 1 mastic adhesive complying with ANSI A136.1, or acrylic or latex-modified thinset mortars complying with ANSI A118.4, in accordance with ANSI A108.

3.5 CLEANING

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

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

3.6 PROTECTION

.1 Protect installed products and components from damage during construction.

END OF SECTION 09 28 13

1.0 GENERAL

1.1 RELATED REQUIREMENTS

.1 Gypsum Board Assemblies — Section 09 21 16

.2 Resilient Flooring for Minor Works — Section 09 65 99

1.2 REFERENCES

.1 American National Standards Institute (ANSI)/Ceramic Tile Institute (CTI)
- .1 ANSI A108.1-99, Specification for the Installation of Ceramic Tile (Includes ANSI A108.1A-C, 108.4-.13, A118.1-.10, ANSI A136.1).
- .2 CTI A118.3-92, Specification for Chemical Resistant, Water Cleanable Tile Setting and Grouting Epoxy and Water Cleanable Tile Setting Epoxy Adhesive (included in ANSI A108.1).
- .3 CTI A118.4-92, Specification for Latex Cement Mortar (included in ANSI A108.1).
- .4 CTI A118.5-92, Specification for Chemical Resistant Furan Resin Mortars and Grouts for Tile Installation (included in ANSI A108.1).
- .5 CTI A118.6-92, Specification for Ceramic Tile Grouts (included in ANSI A108.1).

.2 Canadian General Standards Board (CGSB)
- .1 CGSB 71-GP-22M-78 (AMEND.), /Adhesive, Organic, for Installation of Ceramic Wall Tile.
- .2 CAN/CGSB-75.1-M88, Tile, Ceramic.
- .3 CAN/CGSB-25.20-95, Surface Sealer for Floors.

.3 South Coast Air Quality Management District (SCAQMD), California State
- .1 SCAQMD Rule 1168-05, Adhesives and Sealants Applications.

.4 Terrazzo Tile and Marble Association of Canada (TTMAC)
- .1 Tile Specification Guide 09 30 00 2009/2010, Tile Installation Manual.
- .2 Tile Maintenance Guide 2000.

1.3 SUBMITTALS

.1 Provide product data in accordance with Section 01 33 00 - Submittal Procedures.
- .1 Include manufacturer's information on:
  - .1 Ceramic tile, marked to show each type, size, and shape required.
  - .2 Chemical resistant mortar and grout (Epoxy and Furan).
  - .3 Cementitious backer unit.
  - .4 Dry-set cement mortar and grout.
  - .5 Divider strip.
  - .6 Elastomeric membrane and bond coat.
  - .7 Reinforcing tape.
  - .8 Levelling compound.
  - .9 Latex cement mortar and grout.
  - .10 Commercial cement grout.
  - .11 Organic adhesive.
  - .12 Slip resistant tile.
  - .13 Fasteners.

.2 Provide samples in accordance with Section 01 33 00 - Submittal Procedures.
- .1 Base tile: submit duplicate, full size sample of each colour, texture, size, and pattern of tile.
- .2 Floor tile: submit duplicate, full size sample of each colour, texture, size, and pattern of

tile.

.3 Trim shapes, bullnose cap and cove including bullnose cap and base pieces at internal and external corners of vertical surfaces, each type, colour, and size.

.4 Adhere tile samples to 11 mm thick plywood and grout joints to represent project installation.

1.4 QUALITY ASSURANCE

.1 Quality Assurance Submittals:

.1 Manufacturer's Instructions: manufacturer's installation instructions.

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 - Common Product Requirements.

.2 Waste Management and Disposal:

.1 Separate waste materials for recycling in accordance with Section 01 74 19 - Waste Management and Disposal.

1.6 AMBIENT CONDITIONS

.1 Maintain air temperature and structural base temperature at ceramic tile installation area above 12 degrees C for 48 hours before, during, and 48 hours after, installation.

.2 Do not install tiles at temperatures less than 12 degrees C or above 38 degrees C.

.3 Do not apply epoxy mortar and grouts at temperatures below 15 degrees C or above 25 degrees C.

1.7 MAINTENANCE

.1 Extra Materials:

.1 Provide maintenance materials in accordance with Section 01 78 00 - Closeout Submittals.

.2 Provide minimum 2% of each type and colour of tile required for project for maintenance use. Store where directed.

.3 Maintenance material same production run as installed material.

2.0 PRODUCTS

2.1 INTERIOR FINISH MATERIAL AND COLOUR SCHEDULE

.1 This schedule will be issued as a separate document and may list specific manufacturers related to patterns and colours upon which the colour scheme for the project is based.

.2 The following material specifications, which are prescriptive in nature, are presented in order to establish a quality of product upon which a price can be tendered.

.3 The Departmental Representative will consider substitute Products which meet or exceed the properties of the specified Product and are similar in material, construction, thickness, colour, texture, and overall quality, provided that proposals are submitted to the Departmental Representative complete with samples and whatever other data the Departmental Representative may require in order to evaluate the proposed substitute Product. If the Departmental Representative approves the proposed substitute Product, the Contractor will have the option of providing Product listed in the Finish schedule or an approved alternative.

2.2 PORCELAIN TILE (PRT)

.1 Porcelain tile: to CAN/CGSB-75.1, Type 4, Class MR1 (02 -3.0%), V2 or less variation.
- .1 Size: 300mm x 600mm x 10mm
- .2 Water Absorption: Conform to ISO 10545-3
- .3 Deep Abrasion Resistance: Conform to ISO 10545-6
- .4 Chemical Resistance: Conform to ISO 10545-13
- .5 Frost Resistance: Conform to ISO 10545-12
- .6 Bending Strength: Conform to ISO 10545-4
- .7 Colour & Pattern: Refer to Interior Finish Material and Colour Schedule.

2.3 MORTAR AND ADHESIVE MATERIALS

.1 Cement: to CSA-A5, type 10.

.2 Sand: to ASTM C 144, passing 16 mesh.

.3 Hydrated lime: to ASTM C 207, in accordance with TTMAC Installation Manual.

.4 Latex additive: formulated for use in cement mortar and thin set bond coat.

.5 Water: potable and free of minerals and chemicals which are detrimental to mortar and grout mixes.

.6 Adhesives:
- .1 Maximum VOC limit 65 g/L to SCAQMD Rule 1168.

2.4 BOND COAT

.1 In accordance with TTMAC Installation Manual.

2.5 GROUT

.1 Colouring Pigments:
- .1 Pure mineral pigments, lime-proof and non-fading, complying with ASTM C 979.
- .2 Colouring pigments to be added to grout by manufacturer.
- .3 Job coloured grout are not acceptable.
- .4 All grouts: Colour as selected by Departmental Representative (premium grades).

.2 Latex Cement Grout: to ANSI A108.1, fast curing, high early strength, polymer-modified, stain resistant, sanded mix for floors, unsanded mix for walls and floors with polished tiles commercial tile grout.

.3 All grout: Colour as selected by Departmental Representative (premium grade).

2.6 ACCESSORIES

.1 Reinforcing mesh: 50 x 50 x 1.6 x 1.6 mm galvanized steel wire mesh, welded fabric design, in flat sheets.

.2 Divider strips: between tile and resilient flooring: 5mm thick stainless steel, depth to suit.

.3 Transition Strips: purpose made metal extrusion; zinc type.

.4 Reducer Strips: purpose made metal extrusion; zinc type; maximum slope of 1:2.

.5 Prefabricated Movement Joints: purpose made, having a Shore A Hardness not less than 60 and

elasticity of plus or minus 40 percent when used in accordance to TTMAC Detail 301EJ.

.6 Sealant: in accordance with Section 07 92 00 - Joint Sealants.
- .1 Sealants: maximum VOC limit 250 g/L to SCAQMD Rule 1168.

.7 Tile sealer and protective coating: to tile and grout manufacturers' recommendations.

.8 Edge Protection: For all exterior corners and edges of tile surfaces. L-shaped profile with 3.2 mm wide top section and vertical section forming visible surface, integrated. Trapezoid-perforated anchoring leg and an 87° sloped vertical wall protection, material to be aluminum, in anodized or color-coated finish. Width to suit thickness. Product reference: Refer to Interior Finish Material and Colour Schedule.

.9 Shower curb corner transition to resilient flooring: Cove-shaped profile transitions with single trapezoid-perforated anchoring leg that is secured in the mortar bond coat and a dovetailed channel which is bonded to floor surfaces; 10mm (3/8") wide radius, height to suit porcelain tile thickness; material to be aluminum, in anodized finish to be selected from manufacturer's full standard range. Product reference: Refer to Interior Finish Material and Colour Schedule.

2.7 MIXES

.1 Cement:
- .1 Scratch coat: 1 part cement, 1/5 to 1/2 parts hydrated lime to suit job conditions, 4 parts sand, 1 part water, and latex additive where required. Adjust water volume depending on water content of sand.
- .2 Slurry bond coat: cement and water mixed to creamy paste. Latex additive may be included.
- .3 Mortar bed for floors: 1 part cement, 4 parts sand, 1 part water. Adjust water volume depending on water content of sand. Latex additive may be included.
- .4 Mortar bed for walls and ceilings: 1 part cement, 1/5 to 1/2 parts hydrated lime to suit job conditions, 4 parts sand and 1 part water. Adjust water volume depending on water content of sand.
- .5 Levelling coat: 1 part cement, 4 parts sand, minimum 1/10 part latex additive, 1 part water including latex additive.
- .6 Bond or setting coat: 1 part cement, 1/3 part hydrated lime, 1 part water.
- .7 Measure mortar ingredients by volume.

.2 Dry set mortar: mix to manufacturer's instructions.

.3 Organic adhesive: pre-mixed.
- .1 Adhesives: maximum VOC limit to SCAQMD Rule 1168.

.4 Mix bond and levelling coats, and grout to manufacturer's instructions.

.5 Adjust water volumes to suit water content of sand.

2.8 PATCHING AND LEVELLING COMPOUND

.1 Cement base, acrylic polymer compound, manufactured specifically for resurfacing and leveling concrete floors. Products containing gypsum are not acceptable.

.2 Have not less than the following physical properties:
- .1 Compressive strength - 25 MPa.
- .2 Tensile strength - 7 MPa.

.3 Flexural strength - 7 MPa.
.4 Density - 1.9.

.3 Capable of being applied in layers up to 50 mm thick, being brought to feather edge, and being trowelled to smooth finish.

.4 Ready for use in 48 hours after application.

2.9 CLEANING COMPOUNDS

.1 Specifically designed for cleaning masonry and concrete and which will not prevent bond of subsequent tile setting materials including patching and leveling compounds and elastomeric waterproofing membrane and coat.

.2 Materials containing acid or caustic material are not acceptable.

3.0 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 WORKMANSHIP

.1 Do tile work in accordance with TTMAC Tile Installation Manual 2009/2010, "Ceramic Tile", except where specified otherwise.

.2 Apply tile or backing coats to clean and sound surfaces.

.3 Fit tile around corners, fitments, fixtures, drains and other built-in objects. Maintain uniform joint appearance. Cut edges smooth and even. Do not split tiles.

.4 Maximum surface tolerance 1:800.

.5 Make joints between tile uniform and approximately 1.5 mm wide, plumb, straight, true, even and flush with adjacent tile. Ensure sheet layout not visible after installation. Align patterns.

.6 Lay out tiles so perimeter tiles are minimum 1/2 size.

.7 Sound tiles after setting and replace hollow-sounding units to obtain full bond.

.8 Make internal angles square, external angles rounded.

.9 Use round edged tiles at termination of wall tile panels, except where panel abuts projecting surface or differing plane.

.10 Install divider strips at junction of tile flooring and dissimilar materials.

.11 Allow minimum 24 hours after installation of tiles, before grouting.

.12 Clean installed tile surfaces after installation and grouting cured.

3.3 WALL TILE

.1 Install in accordance with TTMAC detail, for suitable substrates and applicable conditions.

3.4 FLOOR TILE

.1 Install in accordance with TTMAC details for suitable substrates and applicable conditions.

3.5 BASE TILE

.1 Install in accordance with TTMAC detail for suitable substrates and applicable conditions.

3.6 FLOOR SEALER AND PROTECTIVE COATING

.1 Apply in accordance with manufacturer's instructions.

3.7 FIELD QUALTIY CONTROL

.1 Manufacturer's Field Services:

.1 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.

3.8 CLEANING

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

END OF SECTION 09 30 13

1.0 GENERAL

1.1 RELATED REQUIREMENTS

.1 Gypsum Board Assemblies Section 09 21 16

.2 Ceramic Tiling Section 09 30 13

1.2 REFERENCES

.1 National Floor Covering Association (NFCA) Specification Manual.

.2 ASTM F1913 - 04(2010) Standard Specification for Vinyl Sheet Floor Covering Without Backing.

.3 Fire: ASTM E648 – Class 1; Smoke: ASTM E662 – 450 or less, CAN/ULC S102.2-M88.

1.3 QUALITY ASSURANCE

.1 Work to be in accordance with manufacturer's standard specifications and supervised by a certified installer whose work has been approved by the manufacturer of the materials used.

.2 All preparation, materials and workmanship shall be in strict accordance with NFCA requirements and material manufacture’s written recommendation and detail requirements for conditions of work that apply and guarantee/warranty periods noted herein.

1.4 SUBMITTALS

.1 General: Submit for Consultant's review, in accordance with Section 01 33 00.

.2 Submit shop drawings, seaming plan, coving details, and manufacturer's technical data, installation and maintenance instructions (latest edition of manufacturer’s manual) for flooring and accessories.

.3 Samples: Submit duplicate 300 x 300 mm sample pieces of each type of resilient sheet flooring and, 300 mm long welding rod.

.4 Submit product literature of Materials, together with the proposed ordering and delivery schedule for all such materials.

.5 Substrate Tests: Submit copies of moisture and alkalinity tests.

.6 Closeout Submittals:

- .1 Submit 4 copies of the following for incorporation into manual as specified in Division 1.
- .2 Maintenance and operations data includes – methods for maintaining installed products, and precautions against cleaning materials and methods detrimental to finishes and performance.
- .3 Warranty: Warranty documents specified herein.

.7 Flame Spread Certification: Submit manufacturer’s certification that resilient flooring furnished for areas indicated to comply with required flame spread rating has been tested and meets or exceeds indicated standard.

.8 Replacement Material: After completion of work, deliver to project site and store where directed, replacement materials from same manufactured lot as materials installed, and as follows:

- .1 Sheet Flooring: 3m length x width of roll of sheet of each type, pattern and color installed. Identify each roll.
- .2 All maintenance materials to be in one piece as packaged by the manufacturer.

1.5 WARRANTY

.1 Guarantee: Provide a written guarantee in a form acceptable to Owner, that the work of this Section is guaranteed against shrinking, stretching, creeping, lack of adhesion and failure due to defective products and/or workmanship, for a period of five (5) years from the date of Substantial Performance.

1.6 ENVIRONMENTAL CONDITIONS

.1 Maintain air temperature and structural base temperature at flooring installation areas above 20°C for 72 hours before laying, during and 72 hours after installation.

.2 Moisture: Ensure substrate is within moisture limits and alkalinity limits prescribed by manufacturer.

1.7 PRODUCT DELIVERY, STORAGE AND HANDLING

.1 Deliver and store materials in original containers, with manufacturer's labels and seals intact, in a dry weatherproof building.

.2 Store resilient products and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by the manufacturer, but not less than 55 deg F (13 deg C) or more than 85 deg F (29 deg C) minimum for 72 hours prior to laying.

1.8 JOB CONDITIONS

.1 Inspect all surfaces prior to start of work and report any unsatisfactory conditions to the Consultant. Starting work shall imply acceptance.

.2 Do not commence installation until moisture tests have been conducted and conditions are found to be acceptable.

.3 Obtain instruction from Consultant before starting work, concerning directions of patterns and grains of resilient coverings.

.4 Consult other trades in advance and make provisions for work of other trades to avoid cutting and patching.

.5 Protect surrounding surfaces from soiling; make good defects.

.6 Follow manufacturer’s recommendation for project conditions requirements.

2.0 PRODUCTS

2.1 INTERIOR FINISH MATERIAL AND COLOUR SCHEDULE

.1 This schedule will be issued as a separate document and may list specific manufacturers related to patterns and colours upon which the colour scheme for the project is based.

.2 The following material specifications, which are prescriptive in nature, are presented in order to establish a quality of product upon which a price can be tendered.

.3 The Departmental Representative will consider substitute Products which meet or exceed the properties of the specified Product and are similar in material, construction, thickness, colour, texture, and overall quality, provided that proposals are submitted to the Departmental Representative complete with samples and whatever other data the Departmental Representative may require in order to evaluate the proposed substitute Product. If the Departmental Representative approves the proposed substitute Product, the Contractor will have the option of providing Product listed in the Finish schedule or an approved alternative.

2.2 MATERIALS

.1 Sheet Vinyl – SV

.1 Heterogeneous vinyl sheet flooring shall conform to the requirements of ASTM F1303 Standard Specification for Sheet Vinyl Floor Covering with Backing, Type I, Grade 3, with Class A backing.

.2	Width:	1.83 / 3.66 meters (use largest width size to minimize joints)
.3	Overall gauge:	1.65mm (65 mils)
.4	Seam Alignment:	No reverse
.5	Backing:	Felt
.6	Fire Performance:	ASTM E 648 – Class 1; ASTM E 662 less than 450
.7	Warranty:	minimum 15-year limited residential warranty
.8	Location:	Bathroom and Kitchen (Refer to Finish Schedule)
.9	Approved Color & Pattern:	Wood / stone / ceramic pattern look. Refer to Interior Finish Material and Colour Schedule.

.2 Accessories:

.1 Metal Schluter transition / reducing & edge strips tapered to meet abutting materials, colour as selected by Consultant.

.2 Provide color vinyl weld rod as produced by sheet flooring manufacturer and intended for heat welding of seams. Color shall be compatible with field color of flooring.

.3 Seam Adhesive: Provide seam adhesive at seams as recommended by resilient flooring manufacturer.

.3 Primers and Levelers: Compatible types as recommended by flooring and adhesive manufacturers. Leveling and filler compound to be two-component type, consisting of liquid latex and dry-mixed filler, both supplied by same manufacturer.

.4 Adhesives: Waterproof type recommended by flooring manufacturer for the applicable conditions. Use special base adhesive.

.5 Sealer and Wax: Types recommended by resilient flooring manufacturer for material type and location and approved by Owner's Maintenance Department.

3.0 EXECUTION

3.1 INSPECTION

.1 Ensure concrete floors are smooth, dry and free from scale and other foreign matter likely to be detrimental to flooring.

.2 Take moisture and alkalinity tests. Use test method recommended by flooring manufacturer.

.3 Notify Consultant in writing of conditions that may affect finished flooring prior to start of work.

.4 Start of work implies acceptance of substrates.

3.2 PREPARATION

.1 Remove grease, dust and dirt remaining, fill cracks, holes, joints, with approved joint filler and rough grind to eliminate irregularities. Prohibit traffic until filler is cured and dry. Vacuum floor.

.2 Prep floor with concrete leveller as needed especially at location of demolished partition walls. Level floor within the same room.

.3 Carry out any additional preparation or work as may be required, in order to ensure a satisfactory installation, including flush leveled between floor finish changes.

.4 Where required, prime surfaces with primers recommended by adhesives manufacturer.

3.3 INSTALLATION

.1 General:

.1 All primers, where recommended, shall be mandatory.

.2 Provide reference markers. Use chalk or other non-permanent marking devices.

.3 All tools and methods of application shall be strictly in accordance with the manufacturer's printed instruction, unless specified otherwise.

.4 Work shall be installed in accordance with approved manufacturer's standard specifications, supervised by a certified installer whose work has been approved by the manufacturer of the materials being used.

.5 At completion, all flooring shall be completely adhered to the substrate throughout and free of bumps caused by installation over improperly prepared substrate and/or loose particles covering the substrate.

.6 Work shall be subject to nominal inspection of the manufacturer's representative during and after installation.

.2 Sheet Flooring:

.1 Apply adhesive uniformly using recommended trowel. Do not spread more adhesive than can be covered by flooring before initial set takes place.

.2 Lay flooring to produce a minimum number of seams. Border widths minimum 1/3 width of full material. Avoid cross seams, filler pieces, and strips. Match edges for color shading and pattern at the seams in compliance with the manufacturer's recommendations.

.3 Double cut sheet joints and continuously seal. Heat weld seams according to manufacturer's printed instructions.

.4 As installation progresses, and after installation, roll flooring with 45 kg minimum roller to ensure full adhesion.

.5 Cut flooring neatly around fixed objects. Continue flooring over areas that will be under built-in furniture.

.6 Terminate flooring at interior of door in openings where adjacent floor finish or colour is dissimilar.

.7 Install edge strips at unprotected or exposed edges where flooring terminates.

.8 Install continuous bead of clear silicone sealant at joint where flooring terminates against walls prior to installing rubber base.

.9 Install flooring to pattern and direction as directed by consultant. Distribute variation in shade of pattern of production run to obtain uniform effect. Abrupt variations will not be permitted.

.10 Caulk joint between flooring and steel floor plates, door frames, window frames and other similar conditions.

.11 Without damaging surfaces, remove any excess adhesive from the flooring and wall surfaces as the work proceeds.

.12 Prepare heat-welded seams with special routing tool supplied for this purpose and heat weld with vinyl welding rod in seams. Prepare sealed seams with special seam adhesive supplied for this purpose. Use methods and sequence of work in conformance with written instructions of the flooring manufacturer. Finish all seams flush and free from voids, recesses, and raised areas.

.13 Provide integral flash cove wall base where shown on the drawings and Finish Schedule, including cove fillet support strip and top edge cap trim. Construct flash cove base in accordance with the flooring manufacturer's instructions. Heat-weld seams as used on the floor as recommended by manufacturer.

.3 Edge Strip:

.1 Apply edge strip at exposed edges of resilient flooring.

3.4 CLEANING AND WAXING

.1 Remove excess adhesive from floor, base and other surfaces without damage.

.2 Clean, seal and wax floor and base surfaces to flooring manufacturer's printed instructions.

3.5 PROTECTION

.1 Do not allow loads or traffic on flooring for at least 48 hours after installation.

.2 Do not flood with water for at least two (2) weeks after installation.

.3 Protect installed flooring in a manner recommended by flooring manufacturer against damage from rolling loads, the work of other trades, and including the placement of fixtures and furnishings.

.4 Provide manufacturer-recommended regular maintenance, until the date of Substantial Performance.

END OF SECTION 09 65 99

1.0 GENERAL

1.1 RELATED REQUIREMENTS

.1	Finish Carpentry	Section 06 20 00
.2	Architectural Woodwork	Section 06 40 00
.3	Flush Wood Doors	Section 08 14 16
.4	Room Finish Schedule	Section 09 06 00 13
.5	Gypsum Board Assemblies	Section 09 21 16

1.2 REFERENCES

.1 Department of Justice Canada (Jus)
- .1 Canadian Environmental Protection Act (CEPA), 1999, c. 33

.2 Environmental Protection Agency (EPA)
- .1 EPA Test Method for Measuring Total Volatile Organic Compound Content of Consumer Products, Method 24 - 1995, (for Surface Coatings).

.3 Health Canada / Workplace Hazardous Materials Information System (WHMIS)
- .1 Material Safety Data Sheets (MSDS).

.4 Master Painters Institute (MPI)
- .1 MPI Architectural Painting Specifications Manual, latest edition.

.5 National Fire Code of Canada - 1995

.6 Society for Protective Coatings (SSPC)
- .1 SSPC Painting Manual, Volume Two, 8th Edition, Systems and Specifications Manual.

.7 Transport Canada (TC)
- .1 Transportation of Dangerous Goods Act (TDGA), 1992, c. 34.

1.3 QUALITY ASSURANCE

.1 Qualifications:
- .1 Contractor: minimum of five years proven satisfactory experience. Provide list of last three comparable jobs including, job name and location, specifying authority, and project manager.
- .2 Journeymen: qualified journeymen who have "Tradesman Qualification Certificate of Proficiency" engaged in painting work.
- .3 Apprentices: working under direct supervision of qualified trade's person in accordance with trade regulations.

.2 Conform to the standards contained in the Master Painters Institute Architectural Painting Specification Manual, latest edition (hereafter referred to as MPI Painting Specification Manual) for all painting products including preparation and application of materials. MPI Painting Specification Manual as issued by the local MPI Accredited Quality Assurance Association having jurisdiction.

.3 All paint manufacturers and products used shall be as listed under the "Approved Products" section of the MPI Painting Specification manual.

.4 Other paint materials 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.

.5 Single-Source Responsibility: provide primers and undercoat paint produced by the same manufacturer as the finish coat.

.6 All painting and decorating work shall be inspected by Paint Inspection Agency (inspector) acceptable to the specifying authority and the local MPI Accredited Quality Assurance Association. The painting contractor shall notify the Paint Inspection Agency a minimum of one week prior to commencement of work and provide a copy of the project painting specification, plans and elevation drawings (including pertinent details) as well as a Finish Schedule.

.7 All surfaces requiring painting or repainting shall be inspected by the inspection agency who shall advise on all aspects of painting work including preparation, notifying the Consultant, the Contractor and the Trade Contractor of any defects or problems prior to commencing painting work or after the prime coat shows defects in the substrate, and as the work progresses.

.8 Standard of Acceptance:
- .1 Wall: No defects visible from a distance of 1000mm at 90° to surface.
- .2 Final coat to exhibit uniformity of colour and uniformity of sheen across full surface area.

.9 Mock-Ups:

1 Construct mock-ups in accordance with Section 01 45 00 - Quality Control.
- .1 Prepare and paint designated surface, area, room or item (in each colour scheme) to specified requirements, with specified paint or coating showing selected colours, gloss/sheen, textures.
- .2 Mock-up will be used:
  - .1 To judge workmanship, substrate preparation, operation of equipment and material application and workmanship to MPI Architectural Painting Specification Manual standards.
- .3 Locate where directed.
- .4 Allow 24 hours for inspection of mock-up before proceeding with work.
- .5 When accepted, mock-up will demonstrate minimum standard of quality required for this work. Approved mock-up may remain as part of finished work.

.10 Pre-Installation Meeting:
- .1 Convene pre-installation meeting one week prior to beginning work of this Section and on-site installations in accordance with Section 01 32 16.07 - Construction Progress Schedules - Bar (GANTT) Chart
  - .1 Verify project requirements.
  - .2 Review installation and substrate conditions.
  - .3 Coordination with other building subtrades.
  - .4 Review manufacturer's installation instructions and warranty requirements.

.11 Health and Safety:
- .1 Do construction occupational health and safety in accordance with Section 01 35 33 -

Health and Safety Requirements.

1.4 PERFORMANCE REQUIREMENTS

.1 Environmental Performance Requirements:

.1 Provide paint products meeting MPI "Environmentally Friendly" E1, E2, E3 ratings based on VOC (EPA Method 24) content levels.

.2 Green Performance in accordance with MPI Standard GPS-

1.5 SCHEDULING

.1 Submit work schedule for various stages of painting to Departmental Representative for review. Submit schedule minimum of 48 hours in advance of proposed operations.

.2 Obtain written authorization from Departmental Representative for changes in work schedule.

.3 Schedule painting operations to prevent disruption of occupants.

1.6 SUBMITTALS

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

.2 Product Data:

.1 Submit product data and instructions for each paint and coating product to be used.

.2 Submit product data for the use and application of paint thinner.

.3 Submit two copies of Workplace Hazardous Materials Information System (WHMIS) Material Safety Data Sheets (MSDS) in accordance with Section 01 33 00 - Submittal Procedures. Indicate VOCs during application.

.3 Samples:

.1 Submit triplicates 200 x 300 mm sample panels of each paint, stain, or clear coating with specified paint or coating in colours, gloss/sheen and textures required to MPI Architectural Painting Specification Manual standards submitted on following substrate materials:

.1 3 mm plate steel for finishes over metal surfaces.

.2 10 mm hardboard plywood for finishes over wood surfaces.

.3 13 mm gypsum board for finishes over gypsum board and other smooth surfaces.

.2 Retain reviewed samples on-site to demonstrate acceptable standard of quality for appropriate on-site surface.

.3 Test reports: submit certified test reports for paint from approved independent testing laboratories, indicating compliance with specifications for specified performance characteristics and physical properties.

.1 Lead, cadmium and chromium: presence of and amounts.

.2 Mercury: presence of and amounts.

.3 Organochlorines and PCBs: presence of and amounts.

.4 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.5 Manufacturer's Instructions:

.1 Submit manufacturer's installation instructions.

.6 Closeout Submittals: submit maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals include following:

.1 Product name, type and use.

.2 Manufacturer's product number.

.3 Colour numbers.

.4 MPI Environmentally Friendly classification system rating.

1.7 MAINTENANCE

.1 Extra Materials:

.1 Deliver to extra materials from same production run as products installed. Package products with protective covering and identify with descriptive labels. Comply with Section 01 78 00 - Closeout Submittals.

.2 Quantity: provide one - 4 litre (1 gallon) can of each type and colour of primer stain finish coating. Identify colour and paint type in relation to established colour schedule and finish system.

.3 Delivery, storage and protection: comply with Departmental Representative requirements for delivery and storage of extra materials.

1.8 DELIVERY, STORAGE AND HANDLING

.1 Packing, Shipping, Handling and Unloading:

.1 Pack, ship, handle and unload materials in accordance with Section 01 61 00 - Common Product Requirements and manufacturer's written instructions.

.2 Acceptance at Site:

.1 Identify products and materials with labels indicating:

.1 Manufacturer's name and address.

.2 Type of paint or coating.

.3 Compliance with applicable standard.

.4 Colour number in accordance with established colour schedule.

.3 Remove damaged, opened and rejected materials from site.

.4 Storage and Protection:

.1 Provide and maintain dry, temperature controlled, secure storage.

.2 Store materials and supplies away from heat generating devices.

.3 Store materials and equipment in well-ventilated area with temperature range 7 degrees C to 30 degrees C.

.5 Store temperature sensitive products above minimum temperature as recommended by manufacturer.

.6 Keep areas used for storage, cleaning and preparation clean and orderly. After completion of operations, return areas to clean condition.

.7 Remove paint materials from storage only in quantities required for same day use.

.8 Fire Safety Requirements:

.1 Provide one 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 National Fire Code of Canada requirements.

.9 Waste Management and Disposal:

.1 Separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

.2 Remove from site and dispose of packaging materials at appropriate recycling facilities.

.3 Collect and separate for disposal paper, plastic, polystyrene corrugated cardboard and

packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan (WMP).

.4 Separate for recycling and place in designated containers Steel, Metal, Plastic waste in accordance with Waste Management Plan (WMP).

.5 Place materials defined as hazardous or toxic in designated containers.

.6 Handle and dispose of hazardous materials in accordance with CEPA, TDGA, Regional and Municipal, regulations.

.7 Ensure emptied containers are sealed and stored safely.

.8 Unused paint, coating materials must be disposed of at official hazardous material collections site as approved by Departmental Representative.

.9 Paint, stain and wood preservative finishes and related materials (thinners and solvents) are regarded as hazardous products and are subject to regulations for disposal. Information on these controls can be obtained from Provincial Ministries of Environment and Regional levels of Government.

.10 Material which cannot be reused must be treated as hazardous waste and disposed of in an appropriate manner.

.11 Place materials defined as hazardous or toxic waste, including used sealant and adhesive tubes and containers, in containers or areas designated for hazardous waste.

.12 To reduce the amount of contaminants entering waterways, sanitary/storm drain systems or into ground follow these procedures:

.1 Retain cleaning water for water-based materials to allow sediments to be filtered out.

.2 Retain cleaners, thinners, solvents and excess paint and place in designated containers and ensure proper disposal.

.3 Return solvent and oil soaked rags used during painting operations for contaminant recovery, proper disposal, or appropriate cleaning and laundering.

.4 Dispose of contaminants in approved legal manner in accordance with hazardous waste regulations.

.5 Empty paint cans are to be dry prior to disposal or recycling (where available).

.13 Where paint recycling is available, collect waste paint by type and provide for delivery to recycling or collection facility.

.14 Set aside and protect surplus and uncontaminated finish materials. Deliver to or arrange collection by organizations for verifiable re-use or re-manufacturing.

1.9 SITE CONDITIONS

.1 Heating, Ventilation and Lighting:

.1 Provide heating facilities to maintain ambient air and substrate temperatures above 10 degrees C for 24 hours before, during and after paint application until paint has cured sufficiently.

.2 Provide continuous ventilation for seven days after completion of application of paint.

.3 Coordinate use of existing ventilation system with Departmental Representative and ensure its operation during and after application of paint as required.

.4 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.

.5 Provide minimum lighting level of 323 Lux on surfaces to be painted.

.2 Temperature, Humidity and Substrate Moisture Content Levels:

.1 Unless pre-approved written approval by Paint Inspection Agency Authority and product manufacturer, perform no painting when:

.1 Ambient air and substrate temperatures are below 10 degrees C.

.2 Substrate temperature is above 32 degrees C unless paint is specifically

formulated for application at high temperatures.

.3 Substrate and ambient air temperatures are not expected to fall within MPI or paint manufacturer's prescribed limits.

.4 The relative humidity is under 85% or when the dew point is more than 3 degrees C variance between the air/surface temperature. Paint should not be applied if the dew point is less than 3 degrees C below the ambient or surface temperature. Use sling psychrometer to establish the relative humidity before beginning paint work.

.5 Rain or snow are forecast to occur before paint has thoroughly cured or when it is foggy, misty, raining or snowing at site.

.6 Ensure that conditions are within specified limits during drying or curing process, until newly applied coating can itself withstand 'normal' adverse environmental factors.

.2 Perform painting work when maximum moisture content of the substrate is below:

.1 Allow new concrete and masonry to cure minimum of 28 days.

.2 15% for wood.

.3 12% for plaster and gypsum board.

.3 Test for moisture using calibrated electronic Moisture Meter. Test concrete floors for moisture using "cover patch test".

.4 Test concrete, masonry and plaster surfaces for alkalinity as required.

.3 Surface and Environmental Conditions:

.1 Apply paint finish in areas where dust is no longer being generated by related construction operations or when wind or ventilation conditions are such that airborne particles will not affect quality of finished surface.

.2 Apply paint to adequately prepared surfaces and to surfaces within moisture limits.

.3 Apply paint when previous coat of paint is dry or adequately cured.

.4 Additional interior application requirements:

.1 Apply paint finishes when temperature at location of installation can be satisfactorily maintained within manufacturer's recommendations.

.2 Apply paint in occupied facilities during silent hours only. Schedule operations to approval of Departmental Representative such that painted surfaces will have dried and cured sufficiently before occupants are affected.

1.10 GUARANTEE

.1 Furnish a 100% two (2) year Maintenance Bond.

.2 Painting and decorating Subcontractors providing a Maintenance Bond shall provide a maintenance bond consent from a reputable surety company licensed to do business in Canada. Cash or certified cheque are not acceptable in lieu of surety consent.

2.0 PRODUCTS

2.1 MATERIALS

.1 Paint materials listed in the MPI Approved Products List (APL) are acceptable for use on this project.

.2 Provide paint materials for paint systems from single manufacturer.

.3 Only qualified products with E2 "Environmentally Friendly" rating are acceptable for use on this project.

.4 Conform to latest MPI requirements for interior painting work including preparation and priming.

.5 Materials (primers, paints, coatings, varnishes, stains, lacquers, fillers, thinners, solvents, etc.) in accordance with MPI Architectural Painting Specification Manual "Approved Product" listing.

.6 Linseed oil, shellac, and turpentine: highest quality product from approved manufacturer listed in MPI Architectural Painting Specification Manual, compatible with other coating materials as required.

.7 Provide paint products meeting MPI "Environmentally Friendly" E2 ratings based on VOC (EPA Method 24) content levels.

.8 Use MPI listed materials having minimum E2 rating where indoor air quality (odour) requirements exist.

.9 Paints, coatings, adhesives, solvents, cleaners, lubricants, and other fluids:
- .1 Water-based.
- .2 Non-flammable.
- .3 Manufactured without compounds which contribute to ozone depletion in the upper atmosphere.
- .4 Manufactured without compounds which contribute to smog in the lower atmosphere.
- .5 Do not contain methylene chloride, chlorinated hydrocarbons, toxic metal pigments.

.10 Formulate and manufacture water-borne surface coatings with no aromatic solvents, formaldehyde, halogenated solvents, mercury, lead, cadmium, hexavalent chromium or their compounds.

.11 Flash point: 61.0 degrees C or greater for water-borne surface coatings and recycled water-borne surface coatings.

.12 Ensure manufacture and process of both water-borne surface coatings and recycled water-borne surface coatings does not release:
- .1 Matter in undiluted production plant effluent generating 'Biochemical Oxygen Demand' (BOD) in excess of 15 mg/L to natural watercourse or sewage treatment facility lacking secondary treatment.
- .2 Total Suspended Solids (TSS) in undiluted production plant effluent in excess of 15 mg/L to natural watercourse or a sewage treatment facility lacking secondary treatment.

.13 Water-borne paints and stains, recycled water-borne surface coatings and water borne varnishes to meet minimum "Environmentally Friendly" E2 rating.

.14 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 50.0ppm weight/weight total product.
- .3 Cadmium in excess of 1.0ppm 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.

2.2 COLOURS

.1 Refer to Interior Finish Material and Colour Schedule, Section 09 06 00 Finish Schedule and drawings for identification and location of colours.

.2 Interior Finish Material and Colour Schedule:

.1 This schedule will be issued as a separate document and may list specific manufacturers related to patterns and colours upon which the colour scheme for the project is based.

.2 The following material specifications, which are prescriptive in nature, are presented in order to establish a quality of product upon which a price can be tendered.

.3 The Departmental Representative will consider substitute Products which meet or exceed the properties of the specified Product and are similar in material, construction, thickness, colour, texture, and overall quality, provided that proposals are submitted to the Departmental Representative complete with samples and whatever other data the Departmental Representative may require in order to evaluate the proposed substitute Product. If the Departmental Representative approves the proposed substitute Product, the Contractor will have the option

.3 Second coat in 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. Obtain written approval from Departmental Representative for tinting of painting materials.

.2 Mix paste, powder or catalyzed paint mixes in accordance with manufacturer's written instructions.

.3 Use and add thinner in accordance with paint manufacturer's recommendations. Do not use kerosene or similar organic solvents to thin water-based paints.

.4 Thin paint for spraying in accordance with paint manufacturer's instructions.

.5 Re-mix paint in containers prior to and during application to ensure break-up of lumps, complete dispersion of settled pigment, and colour and gloss uniformity.

2.4 GLOSS/SHEEN RATINGS

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

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

.2 Gloss level ratings of painted surfaces as indicated.

2.5 PAINTING SYSTEMS –NEW CONSTRUCTION

.1 Metal Fabrications: steel
  .1 INT 5.1B – Waterborne light industrial gloss level 3 coating.

.2 Steel – high heat: (boilers, furnaces, heat exchangers, breeching, pipes, flues ,stacks, etc.' with temperature range as noted):
  .1 INT 5.2C – Inorganic zinc rich coating, maximum 400 degrees C.

.3 Dresser lumber: doors, casings, mouldings:
  .1 INT 6.3A – High performance architectural latex gloss level 3 finish.

.4 Plaster and gypsum board: gypsum wallboard, drywall, "sheet rock type material", and textured finishes:
  .1 INT 9.2A – Latex gloss level 3 finish (over latex sealer) for wall typical, gloss level 3 for ceiling.

2.6 INTERIOR REPAINTING SYSTEM – EXISTING CONSTRUCTION

.1 Structural Steel and Metal Fabrications:
  .1 RIN 5.1B Waterbourne light industrial gloss level 3 coating.

.2 Galvanized Metal: doors, frames, railings, misc. steel, pipes, overhead decking, ducts, etc.
  .1 RIN 5.3B Waterbourne light industrial gloss level 4 coating.

.3 Plaster and Gypsum Board Surfaces: gypsum wallboard, drywall, "sheet rock type material":, etc.
  .1 RIN 9.2A Latex, gloss level 3 finish for wall typical, gloss level 1 finish for ceiling typical.

.4 Dresser lumber: doors, casings, mouldings:
  .1 RIN 6.3T – High performance architectural latex gloss level 3 finish.

.5 Asphalt Surfaces – Traffic marking.
  .1 REX 2.1A Latex zone/Traffic marking finish.

2.7 SOURCE QUALITY CONTROL

.1 Perform following tests on each batch of consolidated post-consumer material before surface coating is reformulated and canned. Testing by laboratory or facility which has been accredited by 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.

3.0 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 GENERAL

.1 Perform preparation and operations for interior painting in accordance with MPI Architectural Painting Specifications Manual except where specified otherwise.

.2 Apply paint materials in accordance with paint manufacturer's written application instructions.

3.3 EXAMINATION

.1 Investigate existing substrates for problems related to proper and complete preparation of surfaces to be painted. Report to Departmental Representative damages, defects, unsatisfactory or unfavourable conditions before proceeding with work.

.2 Conduct moisture testing of surfaces to be painted using properly calibrated electronic moisture meter, except test concrete floors for moisture using simple "cover patch test". Do not proceed with work until conditions fall within acceptable range as recommended by manufacturer.

.3 Maximum moisture content as follows:
- .1 Stucco, plaster and gypsum board: 12%.
- .2 Wood: 15%.

3.4 PREPARATION

.1 Protection:
- .1 Protect existing building surfaces and adjacent structures from paint spatters, markings and other damage by suitable non-staining covers or masking. If damaged, clean and restore surfaces as directed by Departmental Representative.
- .2 Protect items that are permanently attached such as Fire Labels on doors and frames.
- .3 Protect factory finished products and equipment.
- .4 Protect passing pedestrians, building occupants and general public in and about the building.

.2 Surface Preparation:
- .1 Remove electrical cover plates, light fixtures, surface hardware on doors, bath accessories and other surface mounted equipment, fittings and fastenings prior to undertaking painting operations. Identify and store items in secure location and re-installed after painting is completed.
- .2 Move and cover furniture and portable equipment as necessary to carry out painting operations. Replace as painting operations progress.
- .3 Place "WET PAINT" signs in occupied areas as painting operations progress. Signs to approval of Departmental Representative.

.3 Clean and prepare surfaces in accordance with MPI Architectural Painting Specification Manual requirements. Refer to MPI Manual in regard to specific requirements and as follows:
- .1 Remove dust, dirt, and other surface debris by wiping with dry, clean cloths or compressed air.
- .2 Wash surfaces with a biodegradable detergent and clean warm water using a stiff bristle brush to remove dirt, oil and other surface contaminants.
- .3 Rinse scrubbed surfaces with clean water until foreign matter is flushed from surface.
- .4 Allow surfaces to drain completely and allow to dry thoroughly.
- .5 Prepare surfaces for water-based painting, water-based cleaners should be used in place of organic solvents.
- .6 Use trigger operated spray nozzles for water hoses.
- .7 Many water-based paints cannot be removed with water once dried. Minimize use of mineral spirits or organic solvents to clean up water-based paints.

.4 Prevent contamination of cleaned surfaces by salts, acids, alkalis, other corrosive chemicals, grease, oil and solvents before prime coat is applied and between applications of remaining coats.

Apply primer, paint, or pretreatment as soon as possible after cleaning and before deterioration occurs.

.5 Where possible, prime non-exposed surfaces of new wood surfaces before installation. Use same primers as specified for exposed surfaces.
- .1 Apply vinyl sealer to MPI #36 over knots, pitch, sap and resinous areas.
- .2 Apply wood filler to nail holes and cracks.
- .3 Tint filler to match stains for stained woodwork.

.6 Sand and dust between coats as required to provide adequate adhesion for next coat and to remove defects visible from a distance up to 1000 mm.

.7 Clean metal surfaces to be painted by removing rust, loose mill scale, welding slag, dirt, oil, grease and other foreign substances in accordance with MPI requirements. Remove traces of blast products from surfaces, pockets and corners to be painted by brushing with clean brushes or vacuum cleaning.

.8 Touch up of shop primers with primer as specified.

.9 Do not apply paint until prepared surfaces have been accepted by Departmental Representative.

3.5 APPLICATION

.1 Method of application to be as approved by Departmental Representative. Apply paint by brush, roller, air or airless sprayer. Conform to manufacturer's application instructions unless specified otherwise.

.2 Brush and Roller Application:
- .1 Apply paint in uniform layer using brush and/or roller type suitable for application.
- .2 Work paint into cracks, crevices and corners.
- .3 Paint surfaces and corners not accessible to brush using spray daubers and/or sheepskins. Paint surfaces and corners not accessible to roller using brush, daubers or sheepskins.
- .4 Brush and/or roll out runs and sags, and over-lap marks. Rolled surfaces free of roller tracking and heavy stipple.
- .5 Remove runs, sags and brush marks from finished work and repaint.

.3 Spray application:
- .1 Provide and maintain equipment that is suitable for intended purpose, capable of atomizing paint to be applied, and equipped with suitable pressure regulators and gauges.
- .2 Keep paint ingredients properly mixed in containers during paint application either by continuous mechanical agitation or by intermittent agitation as frequently as necessary.
- .3 Apply paint in uniform layer, with overlapping at edges of spray pattern. Back roll first coat application.
- .4 Brush out immediately all runs and sags.
- .5 Use brushes and rollers to work paint into cracks, crevices and places which are not adequately painted by spray.

.4 Use dipping, sheepskins or daubers only when no other method is practical in places of difficult access.

.5 Apply coats of paint continuous film of uniform thickness. Repaint thin spots or bare areas before next coat of paint is applied.

.6 Allow surfaces to dry and properly cure after cleaning and between subsequent coats for minimum time period as recommended by manufacturer.

.7 Sand and dust between coats to remove visible defects.

.8 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.

.9 Finish closets and alcoves as specified for adjoining rooms.

.10 Finish top, bottom, edges and cutouts of doors after fitting as specified for door surfaces.

3.6 MECHANICAL/ELECTRICAL EQUIPMENT

.1 Paint finished area exposed conduits, piping, hangers, ductwork and other mechanical and electrical equipment with colour and finish to match adjacent surfaces, except as indicated.

.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.

.9 Paint disconnect switches for fire alarm system and exit light systems in red enamel.

.10 Paint natural gas piping yellow.

.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.

3.7 SITE TOLERANCES

.1 Walls: no defects visible from a distance of 1000 mm at 90 degrees to surface.

.2 Ceilings: no defects visible from floor at 45 degrees to surface when viewed using final lighting source.

.3 Final coat to exhibit uniformity of colour and uniformity of sheen across full surface area.

3.8 FIELD QUALITY CONTROL

.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 Departmental Representative.

.4 Standard of Acceptance:

.1 Walls: no defects visible from a distance of 1000 mm at 90 degrees to surface.

.2 Ceilings: no defects visible from floor at 45 degrees to surface when viewed using final lighting source.

.3 Final coat to exhibit uniformity of colour and uniformity of sheen across full surface area.

.5 Field inspection of painting operations to be carried out be independent inspection firm as designated by Departmental Representative.

.6 Advise Departmental Representative when surfaces and applied coating is ready for inspection. Do not proceed with subsequent coats until previous coat has been approved.

.7 Cooperate with inspection firm and provide access to areas of work.

.8 Retain purchase orders, invoices and other documents to prove conformance with noted MPI requirements when requested by Departmental Representative.

3.9 RESTORATION

.1 Clean and re-install hardware items removed before undertaken painting operations.

.2 Remove protective coverings and warning signs as soon as practical after operations cease.

.3 Remove paint splashing on exposed surfaces that were not painted. Remove smears and patter 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.

3.10 PAINT COLOUR SCHEDULE

.1 All interior wall, ceiling, doors and frames, wood base and other areas required painting to be field paint PT.

.2 Refer to Interior Finish Material and Finish Schedule for colors selection.

END OF SECTION 09 91 23

1.0 GENERAL

1.1 RELATED REQUIREMENTS

.1 Rough Carpentry for Minor Works — Section 06 08 99

.2 Finish Carpentry — Section 06 20 00

1.2 REFERENCES

.1 ASTM International

.1 ASTM A 167-99(2009), Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.

.2 ASTM B 456-03, Standard Specification for Electrodeposited Coatings of Copper Plus Nickel Plus Chromium and Nickel Plus Chromium.

.3 ASTM A 653/A 653M-09, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

.4 ASTM A 924/A 924M-09, Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.

.2 Canada Green Building Council (CaGBC)

.1 LEED Canada-CI Version 1.0- 2007, LEED (Leadership in Energy and Environmental Design): Green Building Rating System Reference Package For Commercial Interiors.

.3 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-1.81-M90, Air Drying and Baking Alkyd Primer for Vehicles and Equipment.

.2 CAN/CGSB-1.88-92, Gloss Alkyd Enamel, Air Drying and Baking.

.3 CGSB 31-GP-107MA-90, Non-inhibited Phosphoric Acid Base Metal Conditioner and Rust Remover.

.4 CSA International

.1 CAN/CSA-B651-04, Accessible Design for the Built Environment.

.2 CAN/CSA-G164-M92(R2003), Hot Dip Galvanizing of Irregularly Shaped Articles.

1.3 SUBMITTALS

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

.2 Product Data:

.1 Provide manufacturer's printed product literature and data sheets and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Shop Drawings:

.1 Indicate size and description of components, base material, surface finish inside and out, hardware and locks, attachment devices, description of rough-in-frame, building-in details of anchors for grab bars.

.5 Sustainable Standards Certification:

.1 Low-Emitting Materials: submit listing of laminate adhesives used in building, verifying that they contain no urea-formaldehyde.

1.4 CLOSEOUT SUBMITTALS

.1 Provide maintenance data for toilet and bath accessories for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

1.5 MAINTENANCE MATERIAL SUBMITTALS

.1 Tools:

.1 Provide special tools required for assembly, disassembly or removal for toilet and bath accessories in accordance with requirements specified in Section 01 78 00 - Closeout Submittals.

.2 Deliver special tools to Departmental Representative.

1.6 DELIVERY, STORAGE AND HANDLING

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

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

.3 Storage and Handling Requirements:

.1 Store materials off ground in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect toilet and bathroom accessories from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

.4 Packaging Waste Management: remove for reuse of pallets, crates, padding, and packaging materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

2.0 PRODUCTS

2.1 MATERIALS

.1 Sheet steel: to ASTM A 653/A 653M with ZF001 designation zinc coating.

.2 Stainless steel sheet metal: to ASTM A 167, Type 304, with satin finish.

.3 Sustainability Characteristics:

.1 Laminate Adhesives.

.1 Urea Formaldehyde Free.

.4 Stainless steel tubing: Type 304, commercial grade, seamless welded 1.2 mm wall thickness.

.5 Fasteners: concealed screws and bolts hot dip galvanized, exposed fasteners to match face of unit. Expansion shields fibre, lead or rubber as recommended by accessory manufacturer for component and its intended use.

2.2 INTERIOR FINISH MATERIAL AND COLOUR SCHEDULE

.1 This schedule will be issued as a separate document and my list specific manufacturers related to style and quality upon which the scheme for the project is based.

.2 The following component specifications, which are prescriptive in nature, are presented in order to establish a quality of product upon which a price can be tendered.

.3 The Departmental Representative will consider substitute Products which meet or exceed the properties of the specified Product and are similar in material, construction, thickness, colour, texture, and overall quality, provided that proposals are submitted to the Departmental Representative complete with samples and whatever other data the Departmental Representative

may require in order to evaluate the proposed substitute Product. If the Departmental Representative approves the proposed substitute Product, the Contractor will have the option of providing Product listed in the Finish schedule or an approved alternative.

2.3 COMPONENTS

.1 All bathroom accessories below to have same finishes and design – products should be within same design collection:

.1 Bathroom Hook (HK): Concealed screws contemporary style wall-mount single robe hook, round mounting plate, metal, brushed nickel finish. Overall dimensions: 45-55mm H x 45-55mm W x 35-45mm projection from wall.

.2 Towel Bar (TB): Concealed screws contemporary style wall-mount double towel bar, round mounting plate, metal, brushed nickel finish. Overall dimensions: 610-665mm L x 45-55mm H x 120-140mm projection from wall, 605-660mm Center-to-Center.

.3 Towel Ring (TR): Concealed screws contemporary style wall-mount towel ring, round mounting plate, metal, brushed nickel finish. Overall dimensions: 152-200mm H x 152-230mm W x 45-65mm projection from wall.

.4 Toilet tissue holder (TTH): Concealed screws contemporary style wall-mount open single roll toilet tissue holder, round mounting plate, metal, brushed nickel finish. Overall dimensions: 95-130mm H x 135-210mm W x 45-75mm projection from wall.

.2 Mirror (MR): One-piece roll-formed construction with continuous integral stiffener on all sides, Type 304 stainless steel channel frame size is 19 x 19 x 9.5 mm with vertical-grain satin finish and mitred corners. No.1 quality, 6mm glass mirror electrolytically copper plated; guaranteed against silver spoilage for 15 years. Mirror corners and back protected by shock absorbing material. Back is galvanized steel, secured to concealed wall hanger with two theft-resistant locking screws. Mirror size to refer to drawing.

.3 Sliding Glass Shower Door (SD):

.1	Door & Door Frame Type:	Frameless
.2	Door Side:	Reversible
.3	Frame & Hardware Finish:	Chrome
.4	Fits Base Type:	Rectangle
.5	Glass Type & Style:	Tempered & Clear
.6	Handle Type:	Bar on both doors (one inside & one outside)
.7	Shower Door Type:	Bypass Sliding
.8	Overall Enclosure Height:	1880mm (74”) minimum
.9	Walk-Thru Height:	1790mm (70.5”) minimum
.10	Bottom Track width:	76.2mm (3”)
.12	Glass Thickness:	8mm
.13	Location:	Shower in Bathroom
.14	Acceptable product:	Refer to Interior Finish Material & Color Schedule.

2.4 FABRICATION

.1 Weld and grind joints of fabricated components flush and smooth. Use mechanical fasteners only where approved.

.2 Wherever possible form exposed surfaces from one sheet of stock, free of joints.

.3 Brake form sheet metal work with 1.5 mm radius bends.

.4 Form surfaces flat without distortion. Maintain flat surfaces without scratches or dents.

.5 Back paint components where contact is made with building finishes to prevent electrolysis.

.6 Hot dip galvanize concealed ferrous metal anchors and fastening devices to CAN/CSA-G164.

.7 Shop assemble components and package complete with anchors and fittings.

.8 Deliver inserts and rough-in frames to job site at appropriate time for building-in. Provide templates, details and instructions for building in anchors and inserts.

.9 Provide steel anchor plates and components for installation on studding and building framing.

2.5 FINISHES

.1 Chrome and nickel plating: to ASTM B 456, satin finish, U.O.N.

.2 Manufacturer's or brand names on face of units not acceptable.

3.0 EXECUTION

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrates and surfaces to receive toilet and bathroom accessories previously installed under other Sections or Contracts are acceptable for product installation in accordance with manufacturer's instructions prior to toilet and bathroom accessories installation.

.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 INSTALLATION

.1 Install and secure accessories rigidly in place as follows:

.1 Stud walls: install steel back-plate to stud prior to plaster or drywall finish. Provide plate with threaded studs or plugs.

.2 Hollow masonry units, existing plaster or drywall: use toggle bolts drilled into cell or wall cavity.

.3 Solid masonry, marble, stone or concrete: use bolt with lead expansion sleeve set into drilled hole.

.4 Toilet and shower compartments: use male to female through bolts.

3.3 ADJUSTING

.1 Adjust toilet and bathroom accessories components and systems for correct function and operation in accordance with manufacturer's written instructions.

.2 Lubricate moving parts to operate smoothly and fit accurately.

3.4 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.

.1 Leave Work area clean at end of each day.

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

.3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 19 - Waste Management and Disposal.

.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 toilet and bathroom accessories installation.

3.6 SCHEDULE

.1 Locate accessories where indicated on drawings. Exact locations to be confirmed by Departmental Representative.

END OF SECTION 10 28 10

1. GENERAL

1.1 Section Scope

.1 This Section specifies general conditions for Divisions 21, 22, 23 and 25 and is to be read, interpreted, and coordinated with all other sections.

1.2 Related Requirements

.1 This section of the Specification forms part of the Contract Documents and is to be read, interpreted, and coordinated with all other parts.

.2 Drawings and General Provisions of the Contract, including General and Supplementary Conditions, Division 00 and Division 01 Specification Sections apply to work specified in this section.

.3 Section 25 05 00 – Common Works Results for Integrated Automation.

1.3 References

.1 The latest revisions of the following standards shall apply unless noted otherwise. Apply the greater requirement called for between the National and British Columbia codes.

.2 National Codes:

.1 National Building Code of Canada 2015 (NBC).

.2 National Energy Code of Canada for Buildings 2015.

.3 National Fire Code of Canada 2015.

.4 National Plumbing Code of Canada 2015.

.3 British Columbia Codes:

.1 British Columbia Building Code 2018 (BCBC).

.2 British Columbia Fire Code 2018.

.3 British Columbia Plumbing Code 2018.

.4 Technical Safety BC regulations and regulatory notices.

.4 American Society of Heating, Refrigeration, and Air-Conditioning Engineers (ASHRAE):

.1 ASHRAE 62.1-01, Ventilation for Acceptable Indoor Air Quality.

.5 Health Canada/Workplace Hazardous Materials Information System (WHMIS):

.1 Material Safety Data Sheets (MSDS).

.6 Electrical Equipment Manufacturers' Association Council (EEMAC):

1.4 Definitions

.1 "concealed" – means hidden from normal sight in furred spaces, shafts, ceiling spaces, walls and partitions.

.2 "exposed" – means work normally visible, including work in equipment rooms, service tunnels, and similar spaces.

.3 "finished” - means when in description of any area or part of an area or a product which receives a finish such as paint, or in case of a product may be factory finished.

.4 “provision” or "provide" (and tenses of "provide") – means supply and install complete.

.5 "install" (and tenses of "install") – means secure in position, connect complete, test, adjust, verify and certify.

.6 "supply" – means to procure, arrange for delivery to site, inspect, accept delivery and administer supply of products; distribute to areas; and include manufacturer’s supply of any special materials, standard on site testing, initial start-up, programming, basic commissioning, warranties and manufacturers’ assistance to Contractor.

.7 "delete" or "remove" (and tenses of "delete" or “remove”) – means to disconnect, make safe, and remove obsolete materials; patch and repair/finish surfaces to match adjoining similar construction; include for associated re-programming of systems and/or change of documentation identifications to suit deletions, and properly dispose of deleted products off site unless otherwise instructed by Departmental Representative.

.8 "BAS" – means building automation system; "BMS" – means building management system; "FMS" – means facility management system; and “DDC” means direct digital controls; references to "BAS", "BMS", "FMS”, and “DDC” generally mean same.

.9 "governing authority" and/or "authority having jurisdiction" and/or "regulatory authority" and/or "Municipal authority" – means government departments, agencies, standards, rules and regulations that apply to and govern work and to which work must adhere.

.10 "OSHA" and "OHSA" – stands for Occupational Safety and Health Administration and Occupational Health and Safety Act, and wherever either one is used, they are to be read to mean local governing occupational health and safety regulations that apply to and govern work and to which work must adhere, regardless if Project falls within either authority's jurisdiction.

.11 "Mechanical Divisions" – refers to Divisions 20, 21, 22, 23, 25 and other Divisions as specifically noted, and which work as defined in Specifications and/or on drawings is responsibility of Mechanical Contractor, unless otherwise noted.

.12 "Electrical Divisions" – refers to Divisions 26, 27, 28 and other Divisions as specifically noted, and which work as defined in Specifications and/or on drawings is responsibility of Electrical Contractor, unless otherwise noted.

.13 Wherever words "indicated", "shown", "noted", "listed", or similar words or phrases are used in Contract Documents they are understood, unless otherwise defined, to mean product referred to is "indicated", "shown", "listed", or "noted" on Contract Documents.

.14 Wherever words "reviewed", "satisfactory", "as directed", "submit", or similar words or phrases are used in Contract Documents they are understood, unless otherwise defined, to mean that work or product referred to is "reviewed by", "to the satisfaction of", "submitted to", etc., Departmental Representative.

1.5 General Scope

.1 The scope of Section 22 Plumbing, Section 23 HVAC, and Section 25 Control is for building services within the project structure and 1m from the building.

.2 Provide complete, fully tested, and operational systems to meet the requirements described herein and in complete accord with applicable codes and ordinances.

.3 Contract documents and drawings of this Division are diagrammatic and approximately, to scale unless detailed otherwise. They establish scope, material, and installation quality but are not detailed installation instructions.

.4 Follow manufacturers’ recommended installation instructions, details, and procedures for equipment, supplemented by requirements of the Contract Documents.

.5 Install equipment generally in locations and routes indicated. Run piping and ductwork close to building structure, parallel to building lines, maximize headroom and maintain minimum interference with other services and free space. Remove and replace improperly installed equipment to satisfaction of the Departmental Representative at no extra cost.

.6 For work within existing facilities, confirm locations and elevations of existing piping and equipment prior to commencement of new work.

.7 Install equipment to provide service access, maintain service clearances and for ease of maintenance.

.8 Connect to equipment specified in other Sections and to equipment supplied and installed by other Contractors or by the Departmental Representative. Uncrate equipment, move in place and install complete; start up and test.

.9 Install control dampers and other devices on piping and ductwork, furnished by Division 25.

1.6 Coordination of Work

.1 Cooperate and coordinate with other trades on the project.

.2 Make reference to electrical, mechanical, structural, and architectural drawings when setting out work. Consult with respective Divisions in setting out locations for ductwork, equipment, and piping, so that conflicts are avoided and symmetrical even spacing is maintained. Jointly work out all conflicts on site before fabricating or installing any materials or equipment.

.3 Where dimensional details are required, work with the applicable architectural and structural drawings.

.4 Full size and detailed drawings shall take precedence over scale measurements from drawings. Specifications shall take precedence over drawings.

.5 Any areas indicated as space for future materials or equipment shall be left clear.

1.7 Permits and Fees

.1 All work shall comply with provincial, municipal, bylaws and authorities having jurisdiction.

.2 Obtain all permits and pay all fees applicable to the scope of work.

.3 Contractor shall arrange for inspections of the work by the authorities having jurisdiction and shall provide certificates indicating Final Approval.

1.8 Tender Price Breakdown

.1 Submit a tender price breakdown within thirty (30) days of tender closing and before first progress claim, in a format agreed to with the Departmental Representative.

.2 As a minimum, include the following in the tender price breakdown:

.1	Mechanical:	Equipment, materials, labour
.2	Plumbing:	Equipment, materials, labour
.3	Sheet Metal:	Equipment, materials, labour
.4	Controls:	Equipment, materials, labour

1.9 Submittals

.1 Submittals shall be in accordance with Division 01 - Submittal Procedures, Division 01 – Closeout Procedures, Division 01 – Closeout Submittals and the following:

.2 No work may begin on any segment of this project until submittals have been successfully reviewed for conformity with the design intent.

.3 Contractor shall provide and submit to the Departmental Representative Assurance of Professional Design and Commitment for Field Review by Supporting Registered Professional Schedule S-B and Assurance of Professional Field Review and Compliance by Supporting Registered Professional Schedule S-C for seismic engineering.

.4 Requirements for Contractor Retained Engineers

.1 Professional engineers retained to perform consulting services with regard to Project work, i.e. seismic engineer or structural engineer, are to be members in good standing with local Association of Professional Engineers, and are to carry and pay for errors and omissions professional liability insurance in compliance with requirements of governing authorities in Place of the Work.

.2 Retained engineer’s professional liability insurance is to protect Contractor's consultants and their respective servants, agents, and employees against any loss or damage resulting from professional services rendered by aforementioned consultants and their respective servants, agents, and employees in regards to the Work of this Contract.

.3 Unless otherwise specified in Division 00 or 01, liability insurance requirements are as follows:

.1 Coverage is to be a minimum of $1,000,000.00 CDN inclusive of any one occurrence;

.2 The Contractor must comply with the insurance requirements specified herein. The Contractor must maintain the required insurance coverage for the duration of the Contract. Compliance with the insurance requirements does not release the Contractor from or reduce its liability under the Contract.

.3 The Contractor is responsible for deciding if additional insurance coverage is necessary to fulfill its obligation under the Contract and to ensure compliance with any applicable law. Any additional insurance coverage is at the Contractor's expense, and for its own benefit and protection.

.4 The Contractor must forward to the Contracting Authority within ten (10) days after the date of award of the Contract, a Certificate of Insurance evidencing the insurance coverage and confirming that the insurance policy complying with the requirements is in force. For Canadian-based Contractors, coverage must be placed with an Insurer licensed to carry out business in Canada, however, for Foreign-based Contractors, coverage must be placed with an Insurer with an A.M. Best Rating no less than “A-”. The Contractor must, if requested by the Contracting Authority, forward to Canada a certified true copy of all applicable insurance policies.

.4 Retained consultants are to ascertain that sub-consultants employed by them carry insurance in the form and limits specified above.

.5 Evidence of the required liability insurance in such form as may be required is to be issued to Departmental Representative and Municipal Authorities as required prior to commencement of aforementioned consultant’s services.

.8 Submit shop drawings for all products identified in the relevant specification sections of Divisions 21, 22, 23 and 25. Provide drawings as electronic files (file format: .dwg, .dxf, pdf, or comparable). When manufacturer's cut sheets apply to a product series rather than a specific product, the data specifically applicable to the project shall be highlighted or clearly indicated by other means. Each submitted piece of literature and drawings shall clearly reference the specification and/or drawing that the submittal is to cover. General catalogs shall not be accepted as cut sheets to fulfill submittal requirements. Submittals shall include a complete bill of materials of equipment to be used indicating quantity, manufacturer, model number, and other relevant technical data

.9 Submit the following shop drawings stamped and signed by professional engineer registered or licensed in Province of British Columbia.

.1 Fastening details for Seismic restraints.

.2 Mounting details for spring isolation of equipment.

.10 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 current model production.

.5 Certification for compliance to applicable codes.

.11 Shop drawings to indicate:

.1 Material Specification including CSA or ULC reference numbers.

.2 Installation details to suit the applications on this project.

.3 Operating and maintenance requirements.

.12 Material Safety Data Sheets (MSDS):

.1 Submit Material Safety Data Sheets (MSDS) in accordance with Division 01 - Submittal Procedures for the following products. Indicate VOC emissions, prior to installation or use:

.1 Adhesives.

.2 Caulking compounds.

.3 Sealants.

.4 Insulating materials.

.13 Closeout Submittals:

.1 Provide mechanical operation and maintenance data in compliance with Division 01 - Closeout Submittals and the following:

.1 The Contractor shall furnish and pay for three (3) complete sets of operating and maintenance manuals for the complete mechanical installation plus two (2) copies of the digital version of the manuals on USB type flash drive.

.2 Supply indexed copies of equipment manufacturers' operating and maintenance (O&M) instruction data manuals. Consolidate each copy of data in an identified hard cover three "D" ring binder. Each binder to include:

.1 Front cover: project name; wording – "Mechanical Systems Operating and Maintenance Manual"; and date;

.2 Introduction sheet listing, Contractor, and Subcontractor names, street addresses, telephone and fax numbers, and e-mail addresses;

.3 Equipment manufacturer's authorized contact person name, telephone number and company website;

.4 Table of Contents sheet, and corresponding index tab sheets;

.5 Copy of each "REVIEWED" or clean, updated "REVIEWED AS NOTED" shop drawing or product data sheet, with manufacturer's/supplier's name, telephone and fax numbers, email address, company website address, and email address for local source of parts and service; when shop drawings are returned marked "Reviewed As Noted" with revisions marked on shop drawing copies, they are to be revised by equipment supplier to incorporate comments marked on "Reviewed" shop drawings and a clean updated copy is to be included in operating and maintenance manuals;

.3 Operation and maintenance manual approved by, and final copies deposited with the Departmental Representative a minimum of 7-days before final inspection.

.4 Operation data to include but not limited to:

.1 Pressure test reports, and certificates issued by governing authorities

.2 Control schematics for systems including environmental controls.

.3 Wiring and connection diagrams.

.4 A description of the systems and associated controls.

.5 Description of operation of systems at various loads together with reset schedules and seasonal variances.

.6 Operational instructions for systems and associated components.

.7 A description of actions to be taken in the event of equipment failure.

.8 Valves schedule and flow diagrams.

.9 Colour coding chart.

.5 Maintenance data to include:

.1 Servicing, maintenance, operation, and trouble-shooting instructions for each item of equipment.

.2 Data to include schedules of tasks, frequency, tools required and task time.

.3 Recommended maintenance practices and precautions.

.4 Complete parts lists with numbers.

.6 Performance data to include:

.1 Equipment manufacturer's performance datasheets indicating point of operation as left after commissioning is complete.

.2 Equipment performance verification test results and final commissioning report.

.3 Special performance data as specified.

.4 Testing, adjusting, and balancing.

.7 Digital Version of Manuals

.1 The digital version of the manuals and the hard copy version shall be prepared by the same company.

.2 Utilize latest version of Adobe Acrobat, Portable Document Format (pdf).

.3 The digital manual shall be enhanced with the following features: Bookmarks, Internet Links, and Internal Documents Links and Optical Character Recognition (OCR).

.4 All shop drawings shall be scanned to a minimum 216mm x 279mm size. If the original page is 279mm x 432mm, the digital copy shall also be 279mm x 432mm.

.5 Provide a minimum 300 DPI for all scanned pages.

.6 All scanned material may be searched for text with minimum 60% Optical Character Recognition (OCR).

.7 Rotation of scanned page images/texts shall be displayed within +/- 20 degrees.

.8 Digital manual shall be organized in the same manner as the hard copy manual. Bookmark all major tabs and sub-sections and each set of shop drawings. Link the Table of Contents to the referenced section. Insert Internet Links to the Mechanical Equipment Manufacturers/Suppliers/Contractors official websites

.8 Approvals:

.1 Submit 1 copy of draft Operation and Maintenance Manual to Departmental Representative for approval. Submission of individual data will not be accepted unless directed by Departmental Representative.

.2 Make changes as required and re-submit as directed by Departmental Representative.

.9 Warranties

.1 Include copy of all equipment warranty and extended warranty certificates into the Operation and Maintenance Manual.

.10 Additional data:

.1 Prepare and insert into operation and maintenance manual additional data when need as it becomes apparent during demonstrations and instructions.

.2 Results of Departmental Representative’s Orientation (demonstrations).

.3 List of spare parts turned over to Departmental Representative’s forces.

.2 Site records:

.1 Contractor shall maintain 1 set of white prints at contractors cost to mark changes as work progresses and as changes occur.

.2 Use different colour waterproof ink for each service. Do not use pencil or black ink.

.3 Transfer information weekly to show work as actually installed.

.4 Make available for reference purposes and inspection.

.5 Before applying for a Certificate of Substantial Performance of the Work, update a clean copy of Contract Drawing set in accordance with marked up set of "as-built" white prints including deviations from original Contract Drawings, thus forming an "as-built" drawing set. Submit "as-built" site drawing prints to Departmental Representative for review. Make necessary revisions to drawings as per Departmental Representative's comments, to satisfaction of Departmental Representative.

.3 Record drawings:

.1 Prior to start of Testing, Adjusting and Balancing for Mechanical, finalize production of record drawings.

.2 Use final reviewed "as-built" drawing set to provide CAD files of drawings thus forming true "as-built" set of Contract Drawings. Identify set as "Project Record Copy". Load digital copies of final reviewed by Departmental Representative as-built drawings onto USB type flash drive. Provide 2 complete sets of "as-built" drawings on separate USBs. Submit "as-built" sets of white prints and USBs to Departmental Representative

.3 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).

.4 Submit to Departmental Representative for approval and make corrections as directed.

.5 Perform testing, adjusting and balancing for HVAC using record drawings.

.6 Submit completed reproducible record drawings with Operating and Maintenance Manuals.

.7 Cost to transfer record information onto reproducible media & Auto-CAD are this contractor's responsibility. Departmental Representative will release drawings to contractor after signing a copyright form.

.8 Should the Contractor choose to utilise this Departmental Representative for transferring as built information, allow $400 / sheet for all drawings in the construction set. This will cover costs for drafting time & printing costs.

.9 Submit copies of record drawings for inclusion in final testing and balancing report

.10 Submitted drawings are to be of same quality as original Contract Drawings. CAD drawing files are to be compatible with AutoCAD software release version confirmed with Departmental Representative.

1.10 Spare Parts Submittals

.1 Furnish spare parts in accordance with Division 01 - Closeout Submittals and as follows:

.1 One set of V-belts as applicable for each piece of machinery.

.2 One filter cartridge or set of filter media for each filter or filter bank in addition to final operating set.

.2 Additional spare parts shall also be included as outlined in their appropriate sections.

.3 Provide one set of special tools if required to service equipment as recommended by manufacturers.

1.11 Quality of Work

.1 All work shall be by qualified tradesmen with valid Provincial Trade Qualification Certificates. Spot checks will be made by the Departmental Representative.

.2 Work, which does not conform to standards accepted by the Departmental Representative and the trade, may be rejected by the Departmental Representative. The Contractor shall redo rejected work to the accepted standard at no cost to the Departmental Representative.

1.12 Metric Conversion

.1 All units in this division are expressed in SI units.

.2 Submit all shop drawings and maintenance manuals in SI units.

.3 On all submittals (shop drawings etc.), use the same SI units as stated in the specification.

.4 Equivalent Nominal Diameters of Pipes - Metric and Imperial:

.1 Where pipes are specified with metric dimensions and Imperial sized pipes are available, provide equivalent nominal Imperial sized pipe as indicated in the table, and provide at no extra cost adapters to ensure compatible connections to all metric sized fittings, equipment, and piping.

.2 When CSA approved SI Metric pipes are provided, the Contractor shall provide at no extra cost adapters to ensure compatible connections between the SI Metric pipes and all new and existing pipes, fittings, and equipment.

Equivalent Nominal Diameter Of Pipes					
mm	inches (NPS)	mm	inches (NPS)	mm	inches (NPS)
3	1/8	40	1-1/2	200	8
6	1/4	50	2	250	10
10	3/8	65	2-1/2	300	12
15	1/2	75	3	375	15
20	3/4	100	4	450	18
25	1	125	5	500	20
30	1-1/4	150	6	600	24

.5 Metric Duct Sizes:

.1 The Metric duct sizes are expressed as 25 mm = 1 inch.

1.13 Drawings and Specifications

.1 Drawings and specifications are complementary to each other, and what is called for by one shall be binding as if called for by both.

.2 Should any discrepancy appear between drawings and specifications, which leaves the Contractor in doubt as to the true intent and meaning of the plans, and specifications, obtain written clarification from the Departmental Representative during the tender period. Without a written clarification, the better quality and/or greater quantity of work or materials shall be estimated, performed and furnished within the tendered price.

.3 Examine all contract documents, including all drawings and specifications, and work of other trades to ensure that work is satisfactorily carried out without changes to building.

1.14 Cutting, Patching and Coring

.1 Provide holes and sleeves, cutting and fitting required for mechanical work. Relocate improperly located holes and sleeves.

.2 Drill for expansion bolts, hanger rods, brackets, and supports.

.3 Perform x-rays and obtain written approval from the Departmental Representative before cutting or burning structural members.

.4 Provide openings and holes required in precast members for mechanical work. Cast holes 100 mm or larger in diameter. Field cut smaller than 100 mm.

.5 Patch building where damaged from equipment installation, improperly located holes etc. Use matching materials as specified in the respective section.

.6 Removal of any existing pipe, conduit, or ductwork within a slab core hole or slab opening through floors and roofs must be removed completely, including any associated sleeving, in a safe manner. Provisions are to be made during the removal process to protect any occupants and/or fabric of the space below. The Departmental Representative is to be advised of all existing mechanical service penetration locations, such that site visits and field reviews can be fully co-ordinated and undertaken before and after the opening is closed in and filled.

.7 Filling of any existing slab core or opening is to be with an engineered design of concrete fill complete with doweling for adhesion and/or fire stopping system as appropriate.

1.15 Excavation and Backfill

.1 Provide all excavating to facilitate installation of the mechanical work, including shoring, pumping, 150 mm compacted sand bedding under and first 300 mm of compacted sand over piping and ducting.

.2 Refer to drawing details as applicable.

1.16 Installation of Equipment

.1 Pipe all equipment drains to building drains except systems containing glycol.

.2 Unions and flanges shall be provided in piping or ductwork to permit easy removal of equipment.

.3 Maintain permanent access to equipment for maintenance.

1.17 Connections to Existing Services

.1 Maintain liaison with the Departmental Representative and provide a mutually acceptable schedule to interrupt, reroute or connect to existing building services with the minimum of interruption of those services.

.2 Major services shall not be interrupted before all preparatory work is completed and all required materials are on site. Provide a minimum of 48 hours' notice for all service shutdowns. Allow for major service interruptions outside of normal operating hours of the facility.

.3 Interruptions and shutdowns of existing services shall be by the building/plant maintenance staff. Advise building/plant maintenance staff of the duration of service interruption or shut down.

1.18 Selective Demolition

.1 Reference Standards

.1 Unless otherwise specified, carry out demolition work in accordance to CSA S350-M1980 Code of Practice for Safety in Demolition of Structures.

.2 Remove from site all equipment, ducting or piping which is no longer required because of work under this Contract.

.3 Existing Conditions

.1 Visit and examine the site and note all characteristics and irregularities affecting the work of this Section.

.4 Protection

.1 Prevent movement or settlement of adjacent work. Provide and place bracing or shoring and be responsible for safety of such work. Be liable for any such movement or settlement and any damage or injury caused.

.2 Cease operations and notify the Departmental Representative immediately for special protective and disposal instructions when any asbestos materials are uncovered during the work in this Section.

.3 Prevent debris from blocking surface drainage inlets and all types of drainage piping systems which remain in operation

.5 Salvageable Materials

.1 Except as otherwise stated, salvageable materials from area of demolition shall become the property of the Departmental Representative at his discretion. All material not taken over by the Departmental Representative or removed from the building under this contract shall be removed from this site and disposed of as required by any applicable disposal regulations.

.2 Turnover to and deliver to the Departmental Representative's storage area all items which have been determined to have salvage value and has been removed due to the Work.

1.19 Equipment and Materials

.1 Materials and equipment installed shall be new, CSA approved and of quality specified.

.2 Each major component of equipment shall bear manufacturer's name, address, catalog and serial number in a conspicuous place.

.3 Where two or more products of the same type are required, products shall be of the same manufacturer.

.4 Notify the Departmental Representative in writing ten (10) days prior to the tender close, any materials or equipment specified which is not currently available or will not be available for use as called for herein. Failing this, the contract will assume that the most expensive alternate has been included in the tender price.

.5 All equipment supplied to the project will meet efficiencies as defined in ASHRAE Standard 90.1 and NECB (current versions)

1.20 Cleaning

.1 During construction, keep site reasonably clear of rubbish and waste material resulting from work on a daily basis to the satisfaction of Departmental Representative. Before applying for a Certificate of Substantial Performance of the Work, remove rubbish and debris, and be responsible for repair of any damage caused as a result of work. Refer to Section 01 74 11 Cleaning.

.2 Clean equipment and devices installed as part of this project

1.21 Delivery, Storage and Handling

.1 Deliver, store and handle materials in accordance with Division 01 - Common Product Requirements, the manufacturer's written instructions and the following:

.2 Deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials and equipment in accordance with the manufacturer's recommendations in a clean, dry, well-ventilated area.

.2 Store and protect equipment from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

.4 Protect equipment and materials in storage on site during and after installation until final acceptance. Leave factory covers in place. Take special precautions to prevent entry of foreign material into working parts of piping, equipment and duct systems.

.5 Protect equipment and open-end duct with polyethylene covers and maintain equipment on crates until installation.

.6 Operate, drain and flush out unsealed bearings and refill with fresh oil before final acceptance.

.7 Thoroughly clean piping, ducts and equipment of dirt, cuttings and other foreign substances.

.8 Protect bearings and shafts during installation. Grease shafts and sheaves to prevent corrosion. Supply and install necessary extended nipples for lubrication purposes.

.9 Ensure that existing equipment is carefully dismantled and not damaged or lost. Do not reuse existing materials and equipment unless specifically indicated.

.10 Develop a Construction Waste Management Plan or Waste Reduction Work plan as related to Work of this Section in accordance with Division 01 – Construction Demolition Waste Management and Disposal.

.11 Packaging Waste Management

.1 Remove for reuse and return pallets, crates, padding, packaging materials etc. as specified in the Construction Waste Management Plan or Waste Reduction Work plan in accordance with Division 01 - Construction Demolition Waste Management and Disposal.

1.22 Fire Stopping and Smoke Seals

.1 Provide fire stopping and smoke seals as required in accordance with Division 07 – Fire Stopping.

1.23 Access Doors

.1 General

.1 Provide access doors for maintenance or adjustment of all parts of the mechanical system. This shall apply but not be limited to valves, dampers, cleanouts and controls.

.2 Where equipment is concealed by a ceiling, the location of equipment shall be indicated by coloured markings. Refer to Section 23 05 53 Identification for Mechanical Piping and Equipment.

.3 Where equipment is concealed by a continuous structural or architectural surface, supply access doors of design to suit and match the surface in which they will be installed.

.4 Provide stainless steel doors in walls of washrooms, kitchen, utility rooms and laundry rooms.

.5 Provide Drywall type access doors in all drywall spaces requiring access to equipment.

.6 All fasteners on access panels shall be tamper proof, contractor shall provide three (3) sets of keys.

.7 Locate all access doors outside of secure areas where possible. Where not possible, review the locations of panels with the Departmental Representative prior to installation. All access panels within secure areas are to be of penal quality, lockable, vandal-proof and ligature resistant.

.8 Provide 300 mm x 300 mm minimum size for inspection and hand access.

.9 600 mm x 600 mm minimum size, larger if indicated on drawings, where entry is required and access is difficult.

.10 Size to suit masonry modules when located in a masonry wall.

.11 When located in a finished floor with tile, stonework, terrazzo, etc., a recessed bearing type access door is required. The door surface shall have a recess to take the particular surface material and pattern if this is available at the time the units are ordered.

.12 Security Access Doors:

.1 Access doors for security areas shall be 1.70 mm thick double skinned internally reinforced at 150 mm on centre, 4.76 mm thick, insulated in pressed sink wiped cold rolled steel metal frame (similar to door frame) complete with necessary preparation to receive security lock escutcheon and hinges.

.2 Submittals:

.1 Submit shop drawings for all access doors anticipated on this project.

1.24 Single Point Electrical Connection

.1 If the equipment is indicated on the schedules or within the motor list (both included in the mechanical drawings) as a single point connection, the equipment shall be provided with all integral HOA type starters, internal wiring to all motors, starters, lighting, service outlets etc. such that a single electrical connection can be utilized to power all components within the unit. The unit shall also incorporate the required step-down transformers and wiring to connect all of these internal components including controls wiring. Coordinate with the controls subcontractor for the supply, installation, and wiring of control components.

1.25 Electrical Motors

.1 Supply mechanical equipment complete with electrical motors.

.2 Quality Assurance

.1 Provide motors designed, manufactured, and tested in accordance with the latest edition of the following codes and standards: NEMA, EEMAC, CSA, CEC Part 1, IEEE and ANSI. All motors to be UL listed and CSA labelled.

.2 All motors to be approved for use in the designated area classification by the Provincial Electrical Protection Branch.

.3 The noise level of each motor shall comply with NEMA standards, less than 80 dBA at 1 meter.

.4 Minimum certified motor efficiency shall be as outlined in current version of ASHRAE 90.1and NECB.

.3 Unless specified otherwise, provide motors designed for full voltage starting, EEMAC Design B. Motors driving high torque or high inertia loads may be EEMAC Design C or D.

.4 Provide motors rated for continuous duty with 1.15 service factor unless specified otherwise in the driven equipment specifications. Provide all motors with thermal overload protection.

.5 Motors less than 3/4-hp shall be 120 V, 60 Hz, 1 phase.

.6 All motors shall be 1800 rpm unless otherwise noted.

.7 Provide motors complete with equipment except where indicated.

.8 Provide motors with grease or oil lubricated anti-friction type ball or roller bearings.

.9 Provide motors designed with Class B insulation, Class F insulation for totally enclosed motors.

.10 Motors exposed to outdoor temperature to be lubricated with lubricants suitable for operation at 6 deg. C. below the lowest temperature recorded by ASHRAE or the Climatic Information (Supplement to the National Building Code), for the location in which they are installed.

.11 Where motor power is stated in watts or kilowatts, nominal motor horsepower multiplied by 746 or 0.746 respectively, has been used as the conversion factor.

.12 Submittals

.1 Submit data of test method used and motor efficiencies with shop drawings.

1.26 Motor Starters and Accessories

.1 Motor starters must be capable of starting associated motors under the imposed loads. Confirm starter voltage matches motor prior to ordering.

.2 Unless otherwise specified, starters for 1-phase motors are to be 115 volt; thermal overload protected manual starting switches with a neon pilot light, a surface or recessed enclosure to suit the application, and, where automatic operation is required, a separate H-O-A switch in an enclosure to match starter enclosure.

.3 Starters for 2-speed double winding motors are to be generally as specified above but suitable for motor and equipped with a 45 second time delay to permit equipment to coast down to low speed before it is operated at low speed.

.4 Starters for 2-speed single winding motors are to be generally as specified above but suitable for motor and equipped with a 45 second time delay to permit equipment to coast down to low speed before it is operated at low speed.

.5 Unless otherwise specified, motor starter enclosures are to be in accordance with following NEMA ratings:

.1 Enclosures exposed to the elements – Type 3R, constructed of stainless steel;

.2 Enclosures inside the building in wet areas – Type 3R, constructed of stainless steel;

.3 Enclosures in explosion rated area – Type 7 with exact requirements to suit the area and application;

.4 Enclosures except as noted above – Type 1;

.5 Enclosures located in finished areas – as above but recess type with brushed stainless steel faceplate.

.6 Fuses are to be, unless otherwise scheduled or specified, English Electric Ltd. HRC fuses, Form I Class "J" for constant running equipment and Form II Class "C" for equipment that cycles on and off

1.27 Miscellaneous Metals

.1 Provide all necessary miscellaneous to hang or support materials, equipment and provide access for work under this contract.

.2 All miscellaneous metals shall be prime painted.

.3 Miscellaneous metals shall include but not limited to:

.1 Hangers for equipment, piping and ductwork.

.2 Support for equipment.

1.28 Scaffolding, Hoisting and Rigging

.1 Unless otherwise specified or directed, supply, erect and operate scaffolding, rigging, hoisting equipment and associated hardware required for work, and subject to approval from Departmental Representative.

.2 Immediately remove from site scaffolding, rigging and hoisting equipment when no longer required.

.3 Do not place major scaffolding/hoisting equipment loads on any portion of structure without approval from Departmental Representative.

1.29 Pipe Sleeves

.1 Pipe sleeves shall be provided for piping passing through walls and floors. Minimum schedule 40 steel pipes or factory fabricated, flanged, high-density polyethylene sleeves with reinforced nail bosses. Sleeves shall extend 25 mm on either side of the wall.

.2 Schedule 40 steel pipes shall be used as floor pipe sleeves in wet areas with a 50 mm up-stand.

.3 Review and coordinate sleeve diameters with fire stop installation details as applicable.

.4 Pipe sleeves are not required where pipes pass through cored concrete walls or floors.

1.30 Water Proofing Materials

.1 Modular, mechanical seal assemblies consisting of interlocking synthetic rubber links shaped to continuously fill annular space between pipe and pipe sleeve or wall opening, assembled with stainless steel bolts and pressure plates and designed so when bolts are tightened the links expand to seal the opening watertight. Select seal assemblies to suit pipe size and sleeve size or wall opening size.

1.31 Escutcheons and Plates

.1 Provide escutcheons and plates on all piping and ductwork passing through finished walls, floors and ceilings.

.2 Escutcheons shall be one piece, stainless or chrome plated steel.

1.32 Temporary Heat

.1 Do not use the permanent system for temporary heating purposes without written permission from the Departmental Representative.

.2 If approved, permanent mechanical systems in building may be used for temporary heating during construction subject the following conditions:

.1 Each entire system is complete.

.2 Thoroughly clean and overhaul permanent equipment used during the construction period, replace worn or damaged worn or damaged parts before final inspection.

.3 Use of permanent systems for temporary heat shall not modify terms of warranty.

.4 Operate heating systems under conditions, which ensure no temporary or permanent damage. Operate with proper safety devices and controls installed and fully operational. Operate systems only with treated water as specified.

.5 Air systems shall not be used for temporary heating.

.6 When permanent systems are used for temporary heat, provide alarm indicating system failure. Connect alarm to independent alarm company system.

.7 Energy costs are to be paid by Contractor.

.8 During this period of construction, such systems/equipment to not become property of Departmental Representative or be Departmental Representative's responsibility for maintenance or service. Systems/equipment are to remain property of respective manufacturers/suppliers or Contractor, who are responsible for full maintenance and servicing of systems/equipment in order to maintain validity of warranties after turn over to Departmental Representative.

.9 Prior to application for a Certificate of Substantial Performance of the Work and turn over to Departmental Representative, such systems/equipment to be cleaned, restored to "new" condition, paint finishes "touched-up", filters cleaned or replaced, etc.

1.33 Progress Claim Breakdown

.1 Prior to submittal of first progress payment draw, submit a detailed breakdown of work cost to assist Departmental Representative in reviewing and approving progress payment claims.

.2 Payment breakdown is subject to Departmental Representative's approval and review. Progress payments will not be processed until an approved breakdown is in place. Breakdown is to include one-time claim items such as mobilization and demobilization, insurance, bonds (if applicable), shop drawings and product data sheets, commissioning including testing, adjusting and balancing, system testing and verification, and project closeout submittals.

.3 Indicate equipment, material and labour costs for site services (if applicable) and indicate work of each trade in same manner as indicated on progress draw.

1.34 Notice for Required Field Reviews

.1 Whenever there is a requirement for Departmental Representative to perform a field review prior to concealment of any work, to inspect/re-inspect work for deficiencies prior to Substantial Performance of the Work, for commissioning demonstrations, and any other such field review, give minimum 5 working days' notice in writing to Departmental Representative.

.2 If Departmental Representative is unable to attend a field review when requested, arrange an alternative date and time.

.3 Do not conceal work until Departmental Representative advises that it may be concealed.

.4 When Departmental Representative is requested to perform a field review and work is not ready to be reviewed, reimburse Departmental Representative for time and travel expenses

1.35 Changes in the Work

.1 Whenever Departmental Representative proposes in writing to make a change or revision to design, arrangement, quantity or type of work from that required by Contract Documents, prepare and submit to Departmental Representative for review, a quotation being proposed cost for executing change or revision.

.2 Quotation is to be a detailed and itemized estimate of product, labour, and equipment costs associated with change or revision, plus overhead and profit percentages and applicable taxes and duties.

.3 Make requests for changes or revisions to work to Departmental Representative in writing and, if Departmental Representative agrees, will issue Notice of Change.

.4 Do not execute any change or revision until written authorization for the change or revision has been obtained from Departmental Representative.

1.36 Temporary or Trial Usage

.1 Temporary or trial usage by the Departmental Representative of mechanical equipment supplied under contract shall not represent acceptance.

.2 Repair or replace permanent equipment used temporarily.

.3 Repair or otherwise rectify damage caused by defective materials or workmanship during temporary or trial usage.

1.37 Instruction to Departmental Representative

.1 Refer to equipment and system operational and maintenance training requirements specified in Division 01.

.2 Train Departmental Representative's designated personnel in aspects of operation and maintenance of equipment and systems as specified. Demonstrations and training are to be performed by qualified technicians employed by equipment/system manufacturer/supplier. Supply hard copies of training materials to each attendee.

.3 Unless where specified otherwise in trade Sections, minimum requirements are for manufacturer/suppliers of each system and major equipment, to provide minimum two separate sessions each consisting of minimum 4 hours on site or in factory training (at Departmental Representative's choice), of Departmental Representative's designated personnel, on operation and maintenance procedures of system.

.4 For each item of equipment and for each system for which training is specified, prepare training modules as specified below. Use Operating and Maintenance Manuals during training sessions. Training modules include but are not limited to:

.1 Operational Requirements and Criteria – equipment function, stopping and starting, safeties, operating standards, operating characteristics, performance curves, and limitations;

.2 Troubleshooting – diagnostic instructions, test and inspection procedures;

.3 Documentation – equipment/system warranties, and manufacturer's/supplier's parts and service facilities, telephone numbers, email addresses, and the like;

.4 Maintenance – inspection instructions, types of cleaning agents to be used as well as cleaning methods, preventive maintenance procedures, and use of any special tools;

.5 Repairs – diagnostic instructions, disassembly, component removal and repair instructions, instructions for identifying parts and components, and review of any spare parts inventory.

.5 Before instructing Departmental Representative's designated personnel, submit to Departmental Representative for review preliminary copy of training manual and proposed schedule of demonstration and training dates and times. Incorporate Departmental Representative's comments in final copy.

.6 Obtain in writing from Departmental Representative a list of Departmental Representative's representatives to receive instructions. Submit to Departmental Representative prior to application for Certificate of Substantial Performance of the Work, complete list of systems for which instructions were given, stating for each system:

.1 Date instructions were given to Departmental Representative's staff;

.2 Duration of instruction;

.3 Names of persons instructed;

.4 Other parties present (manufacturer's representative, etc.).

.7 Obtain signatures of Departmental Representative's staff to verify they properly understood system installation, operation and maintenance requirements, and have received operating and maintenance instruction manuals and "as-built" record drawings

1.38 Guarantee / Warranty

.1 Furnish a written guarantee stating that all work executed in this contract will be free from defective workmanship and materials for a period of one (1) year from the date of Substantial Performance. The Contractor shall, at his own expense, repair and replace any work, which fails or becomes defective during the term of the guarantee/warranty, providing such work is not due to improper usage. The period of guarantee specified shall not in any way supplant any other guarantees of a longer period but shall be binding on work not otherwise covered.

.2 Use of permanent systems for temporary heat shall not modify terms of the manufacturers' warranty or the guarantee.

.3 If the equipment is used during construction, the warranty or guarantee period shall not be shortened or altered.

1.39 Substantial and Total Performance

.1 Prior to requesting an inspection for Substantial Performance, provide a complete list of items, which are deficient.

.2 A certificate of Substantial Performance will not be granted unless the following items are completed and available to the Departmental Representative:

.1 Final Plumbing Inspection Certificate from the Authority having Jurisdiction.

.2 Schedule S-C for seismic engineering.

.3 Commissioning checklists are completed and submitted as per Division 01.

.4 Vibration isolation supplier's inspection report

.5 Potable water piping's flushing and chlorination test certificate

.6 Major equipment – suppliers start-up test sheets and letters certifying start up. (packaged equipment)

.7 Draft Operating/Maintenance Manuals have been submitted for review.

.8 All mechanical systems have been commissioned and are capable of operation with alarm controls functional and automatic controls in operation.

.9 Air system has been balanced with draft report submitted to the Departmental Representative.

.10 Mechanical identification is complete.

.11 Warranty forms have been mailed to the manufacturer. Provide copy of the original warranty for equipment, which has a warranty period longer than one year.

.12 Operating and Maintenance demonstrations have been provided to the Departmental Representative.

.13 Written inspection report by manufacturer's representative has been submitted for noise and vibration control devices and flexible connections.

.14 Record drawings have been submitted.

.15 Fan plenums have been cleaned, and temporary filters have been replaced with permanent filters.

.16 All previously identified deficiencies have been corrected and accepted.

.3 Prior to a Total Performance Inspection, provide declaration in writing that deficiencies noted at time of substantial performance inspection have been corrected and the following items completed prior to the total performance inspection:

.1 Submit final air balance report.

.2 Submit final operating and maintenance manuals.

.3 Complete final calibration.

.4 The Departmental Representative shall provide one (1) visitation for the purpose of total performance inspection. Subsequent visitations if required shall be at the expense of the Contractor.

.5 The Contractor shall provide qualified personnel in appropriate numbers to operate the facility until substantial performance is declared.

1.40 Alternate Materials and Equipment

.1 The price submitted for this contract shall be based on the use of materials and equipment as specified.

.2 Requests for alternate equivalent materials or equipment must be submitted to the Departmental Representative no later than seven (7) working days prior to the Mechanical trades' closing tender date. Submit all applicable technical data, including performance curves and physical details for review. Approval of requests shall only be given by addendum.

.3 Approved equivalents and/or alternatives to specified products shall be equal to the specified product in every respect, operate as intended, and meet the space, capacity, and noise requirements outlined.

.4 The Contractor shall be fully responsible for any additional labour and materials required by any trades or other Contractors to accommodate the use of other than specified materials or equipment. The Contractor shall bear any and all costs for design/system modifications to accommodate the "alternate" equipment. Extras will not be approved to cover such work.

2. PRODUCTS

2.1 Existing Services

.1 Disconnect and cap all mechanical services in accordance with requirements of the authority having jurisdiction.

.2 Building Mechanical Services: Maintain activity of all building services during demolition/removal of existing services required of this contract.

.3 Maintain all trap seals and cap open-end pipe to ensure no sewer gas enters the building during renovations or demolition work. Maintain all existing sewer piping in a wet condition daily.

2.2 Demolition

.1 Completely demolish the items scheduled and remove all materials from the premises unless otherwise requested by the Departmental Representative.

.2 Carry out demolition in a manner to cause as little inconvenience to the occupied building area as building area as possible. Co-ordinate this activity with the Departmental Representative.

.3 Carry out demolition in an orderly and careful manner.

.4 All coring, patching and removal of existing equipment, pipes, and ductwork, which may affect the operation of occupied areas of the building, shall be carried out outside of regular office hours or as scheduled with the Departmental Representative.

2.3 Asbestos

.1 The intent is for a Haz-Mat Contractor to remove all asbestos containing material prior to the proposed project work taking place. Notify the Departmental Representative if asbestos containing material is suspected to remain on site.

.2 When new work is required to be connected to existing plumbing, piping, ductwork or equipment, which contains asbestos insulation or products the following, shall apply:

.1 Keep disruption to existing piping and equipment to a minimum

.2 Protect the site and all Contractors from the work

.3 Remove the asbestos at piping and equipment for new connections and carry out work in accordance with Work Safe BC requirements for asbestos removal.

2.4 Core Drilling

.1 Clearly identify all proposed piping penetrations through existing slabs, walls etc. and advise the General Contractor. Obtain x-rays of the locations to ensure penetration will avoid any existing post tension cables or reinforced steel. Advise the Departmental Representative of any conflicts as a result of the x-rays and obtain the Departmental Representative approval before any coring take place.

2.5 Fire Stopping and Smoke Seals

.1 Provide fire-stopping materials as applicable as per Division 07.

2.6 Access Doors

.1 Drywall Surface: Extruded aluminum frame with gypsum board inlay and structural corner elements. Hinge to be concealed 2-point hinge, non-corroding with screwdriver operated cam latch.

.2 Masonry Surface: Universal design, steel door (1.6 mm) and steel frame (1.2 mm), door flush to frame, rounded safety corners, continuous concealed hinge, screwdriver operated cam latch, prime coat grey painted finish.

.3 Tile Surface: Universal design, stainless steel door (1.6 mm) and stainless steel frame (1.2 mm), door flush to frame, rounded safety corners, continuous concealed hinge, screwdriver operated cam latch, #4 satin stainless steel finish.

.4 Plaster Walls and Ceiling: steel door 2 mm and steel frame 2 mm, door flush to frame edge, expansion casing bead and 75 mm wide galvanized lath surround recessed 18 mm to receive plaster, continuous concealed hinge, screwdriver operated cam latch, prime coat grey painted finish.

.5 Acoustic Plaster: Steel door (1.6 mm) and steel frame (2 mm), door recessed 12 mm lined with self-furring lath, 75 mm wide galvanized lath surround recessed 18 mm to receive plaster flush to frame edge, concealed pivoting rod type hinge, screwdriver operated cam latch, prime coat grey painted finish.

.6 Acoustical Tile Ceilings: Steel door (1.6 mm) and steel frame (2 mm), door recessed 25 mm to receive acoustic tile, concealed pivoting rod type hinge, screwdriver operated cam latch, prime coat grey painted finish.

.7 Ductwork: Ultra low leakage type, flat oval design, galvanized steel frame (0.7 mm), double skin galvanized steel door (0.7 mm) with 25mm insulation fully enclosed in panel, bulb type seal integrally fastened to door, lever cam locks. Provide stainless steel in lieu of galvanized steel in stainless steel ductwork.

2.7 Electrical Motors

.1 All Motors, 1 H.P. motors and larger, shall be energy efficient design and have a minimum and nominal full load efficiency, which will meet or exceed the values listed in accordance CAN/CSA C390-1. The minimum efficiency shall be guaranteed.

.2 Belt Drives: Provide belt drives to the following requirements:

.1 Provide steel, cast iron or aluminum sheaves for motors less than 3/4 H.P.

.2 Provide steel or cast iron sheaves keyed to shafts, for motors 3/4 H.P. and larger.

.3 For motors less than 10 H.P. provide standard adjustable pitch drive sheaves having +/-10% range. Use mid-position of range for specified RPM.

.4 Match drive and driven sheaves.

.5 V-belts shall conform to the American Belt Manufacturers standards. Multiple belts shall be matched sets.

.6 Not less than a 2-belt configuration is required for each drive for motors 3/4 H.P. and larger.

.7 Minimum drive rating shall be 150% of nameplate rating of motor. Keep overhung loads within manufacturer's design requirements on prime mover shafts.

.8 Motor slide rail adjustment baseplate with double draw bolt, shall allow for centre line adjustment.

.9 Tension belts to manufacturers recommendations before start up and after 100 hours of operation using calibrated belt tensioning gauge.

.10 Provide one spare set of belts for each piece of equipment with each belt separately identified for the equipment item to be served.

.3 Shaft Couplings: Shaft couplings shall be of the pin or jaw neoprene insert type, gear type, or flexing steel insert type and shall allow coupling inserts to be easily removed without disassembly of the equipment.

.4 Guards:

.1 Provide removable protective guards on all exposed V-belt drives and shaft couplings in accordance with Worker's Compensation Board requirements.

.2 Guards for drives shall have:

.1 1 mm expanded metal screen welded to 25 mm steel angle frame.

.2 1.5 mm thick galvanized sheet metal tops and bottoms.

.3 Removable sides for servicing.

.4 38 mm dia. holes on both shaft centres for insertion of tachometer.

.5 Sectionalize if necessary so one man can handle removal.

.3 Provide means to permit lubrication and use of test instruments with guards in place.

.4 Fabricate and install belt guards for V-belt drives to permit movement of motors for adjusting belt tension and for belt slap.

.5 Provide removable "U" shaped guards for flexible couplings with 2.5 mm thick galvanized frame and 1.2 mm thick expanded mesh face.

.6 Provide guards on all unprotected fan inlets and outlets. Guards to be provided by fan manufacturer.

.7 Prime coat guards and finish paint to match equipment.

.8 Secure guards to equipment allowing for ease of removal.

3. EXECUTION

3.1 Painting Repairs and Restoration

.1 Do painting in accordance with Division 09 - Interior Painting.

.2 Prime and touch up marred finished paintwork to match original.

.3 Restore to new condition, finishes which have been damaged.

.4 Clean exposed bare metal surfaces supplied under Divisions 21, 22, 23 and 25. Apply at least one coat of corrosion resistant primer paint to all supports and equipment fabricated from ferrous metal.

.5 Paint all pipe hangers and exposed sleeves, in exposed areas, with a rust inhibiting primer.

3.2 System Cleaning

.1 Clean interior and exterior of all systems including strainers. Commercially vacuum interior of ductwork and air handling units.

3.3 Field Quality Control

.1 Manufacturer's Field Services:

.1 Obtain written reports from manufacturers’ verifying compliance of the work, in handling, installing, applying, protecting, cleaning and start-up of a product.

.2 Submit Manufacturer's Field Reports as described in PART 1 - Submittals.

.3 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.

3.4 Demonstration

.1 Departmental Representative may use equipment and systems for test purposes prior to acceptance. Supply labour, material, and instruments required for testing.

.2 Supply tools, equipment and personnel to demonstrate and instruct the operating and maintenance personnel in operating, controlling, adjusting, trouble-shooting and servicing of all systems and equipment during regular work hours, prior to acceptance.

.3 Where specified elsewhere in Division 21, 22, 23 or 25 manufacturers to provide demonstrations and instructions.

.4 Use operation and maintenance manual, record drawings, and audio visual aids as part of instruction materials.

.5 Instruction duration requirements shall be as specified in the appropriate sections.

.6 Contractor will record these demonstrations on digital video for future reference.

3.5 Fire Stopping and Smoke Seals

.1 Refer to Division 07.

3.6 Access Doors

.1 Installation:

.1 Provide all access doors required to access work installed by Divisions 21, 22, 23 and 25. Be responsible for coordinating locations, cutting opening and installing panels. Any secondary supports, blocking etc. will be by the ceiling or wall contractor.

.2 Access doors in mechanical equipment to be provided by this Division.

.3 Access panel requirements and locations shall be fully coordinated with all involved contractors prior to the installation of any mechanical systems or equipment.

.2 Location:

.1 Ensure that equipment is within view and accessible for operating, inspecting, adjusting, servicing without using special tools.

.3 Provide 3 sets of each type of access door key to the Departmental Representative at substantial completion. Obtain a signed receipt indicating date, quantity of keys and person receiving keys. Submit receipt to the Departmental Representative.

3.7 Electrical Motors

.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.

.2 Installation:

.1 Unless otherwise noted starters and protection devices will be included under Division 26 - Electrical.

.2 Co-ordinate with Division 26 Contractor to ensure proper connection, correct thermal overload protection and correct motor controls.

.3 Where starters are included in this Division as an integral part of packaged equipment, they shall contain thermal overload protection in all ungrounded lines.

.4 Equipment, which has more than one voltage rating, shall be fed from a single power source through a disconnect switch.

.5 Fasten securely in place.

.6 Make removable for servicing, easily returned into, and positively in position.

.3 Setting and Alignment:

.1 Employ a journeyman millwright to align all V-belt drives and/or shaft coupling drives. The millwright shall check that centrifugal fan wheels are properly centred on fan shafts.

.2 Align shaft couplings, using a dial indicator, to within +/-0.051 mm after grouting is complete and the piping system is operational.

.3 Align V-belt drives using a straight edge.

.4 Submit a certificate from the millwright employed, certifying that all shaft couplings and V-belt drives have been aligned and centrifugal fan wheels centred prior to initial start-up and checked again after final system balance adjustment.

3.8 Protection

.1 Protect equipment and systems openings from dirt, dust, and other foreign materials with materials appropriate to system.

END OF SECTION

1. GENERAL

1.1 Section Scope

.1 Sanitary and storm cleanouts for interior and exterior applications to within 1m from the building.

1.2 Related Requirements

.1 This section of the Specification forms part of the Contract Documents and shall be read, interpreted, and coordinated with all other parts.

.2 Section 21 05 01 – Common Work Results for Mechanical

1.3 References

.1 The latest revisions of the following standards shall apply unless noted otherwise.

.1 Applicable Building Code - Refer to Section 21 05 01

1.4 Submittals

.1 Comply with Division 01 – Submittal Procedures and Closeout Procedures, Section 21 05 01 Common Work Results for Mechanical – Submittals and in addition the following:

.1 Shop drawings:

.1 Cleanouts

.2 Valve boxes

.2 Closeout submittals: submit all reviewed shop drawings for incorporation into manual specified in Section 21 05 01 – Common Work Results for Mechanical

1.5 General Requirements

.1 Provide cleanouts on all sanitary and storm drainage piping at all changes in direction, at the ends of all horizontal runs, at the base of every stack, where drains leave the building; where shown on the drawings and in compliance with the local plumbing code, bylaws and ordinances.

.2 Cleanout spacing on horizontal drainage piping shall be as a maximum:

.1 7.5 m apart in piping less than 3 NPS

.2 15 m apart in piping 3 NPS and 4 NPS

.3 Provide caulked or threaded type cleanouts extended to finished floor wall surface.

.4 Provide bolted cover plate clean-outs on vertical rainwater leaders only. Ensure ample clearance at clean-out for rodding of drainage system.

.5 All cleanouts shall be full pipe size for pipes 4 NPS and smaller.

.6 Cleanouts shall be 4 NPS for pipes 4 NPS and larger.

2. PRODUCTS

2.1 Flashing

.1 Lead Flashing:

.1 Waterproofing: 24.4 kg/sq m sheet lead

.2 Soundproofing: 4.9 kg/sq m sheet lead.

.2 CPE Flashing:

.1 1 mm thick chlorinated polyethylene (CPE).

2.2 Floor - Unfinished Area

.1 Provide the following clean out in unfinished areas such as concrete floors in equipment rooms and flush type C.O. in outside areas.

.1 Cast iron floor level cleanout assembly with extra heavy duty, round, adjustable, scoriated, secured cast iron top and no-hub outlet. Suitable for heavy traffic.

2.3 Floor - Finished Area

.1 Provide the following cleanout for general areas of a building:

.1 Cast iron cleanout with extra heavy duty round, adjustable, scoriated, secured nickel bronze top, and no-hub outlet

.2 Provide the following cleanout for foot traffic areas with sheet goods flooring:

.1 Cast iron floor level cleanout assembly with a square adjustable nickel bronze top with 6mm tile recess, surface membrane clamp and no-hub outlet.

.3 Provide the following for a cleanout in a carpeted floor area subject to foot traffic:

.1 Cast iron floor level cleanout assembly with round, adjustable, scoriated, nickel bronze top, and carpet clamping frame.

.4 Provide the following cleanout in a terrazzo or other poured floor with foot and medium load wheeled traffic:

.1 Cast iron floor level cleanout assembly with round adjustable nickel bronze top with 12mm terrazzo recess and center lifting device, and no-hub outlet

2.4 Wall – Finished Area

.1 Provide the following full calibre caulk ferrule cleanout for a hub opening in drainage piping in a finished wall:

.1 Cast iron full calibre caulk ferrule with cast bronze taper thread plug and stainless steel round cover and screw.

.2 Provide the following cleanout in a concealed drainage line in a finished wall:

.1 Cast iron cleanout tee and cast iron countersunk plug with stainless steel round cover and screw.

2.5 Cleanout – Copper Pipe

.1 Cast brass with raised shoulder on plug and gasket.

2.6 Cleanouts – Cast Iron Pipe

.1 Steel plug type.

3. EXECUTION

3.1 General

.1 Cleanouts shall be extended to a finished wall or floor unless exposed in a basement area or similar. Cleanout piping may require to be extended beyond the room as required for cleanout installation.

.2 All cleanouts passing through walls or floors with a waterproofing membrane shall have a clamping collar, which shall be clamped to the membrane.

.3 All barriers for cleanout plugs shall be securely anchored so that they do not rotate when plug is being removed.

.4 Install cleanouts on vertical risers a minimum of 200mm above finished floor.

.5 Coordinate location of interior cleanouts with millwork and other obstructions such that clearance for access and rodding is maintained.

.6 Cleanouts on outside drains shall be brought to grade and anchored in a concrete collar.

3.2 Flashing

.1 All cleanouts passing through walls or floors subject to hydrostatic pressure and waterproofed by means other than a membrane shall be provided with clamping collars and flashings of 25 kg/m ² lead or equivalent.

3.3 Floor – Unfinished Areas

.1 All outside cleanouts in paved areas shall be extended to grade in cast iron. They shall be sufficiently anchored in a 300 mm x 300 mm x 100 mm thick concrete block of concrete to prevent rotation of the pipe. Concrete work shall be provided and installed by Division 03.

3.4 Floor - Finished Areas

.1 Where cleanouts occur in carpeted areas, they shall be extended to the finished walls unless the Departmental Representative gives special permission for them to terminate in the carpeted floor.

.2 In potentially wet areas such as washrooms, cleanouts shall be extended to the walls wherever possible. Where conditions do not permit wall cleanouts, the cleanout cover shall be waterproof type with nickel bronze frame and cover and integral waterproofing clamping collar.

.3 No cleanouts shall terminate at the ceiling of a room, sanitary and storm shall be extended to the floor above. Cleanouts shall not terminate in the floor of any sterile rooms.

3.5 Access Doors

.1 Access doors shall be in compliance with Section 21 05 01 Common Work Results for Mechanical – Access Doors and the following:

.1 Access doors shall have a minimum clear opening of 200 mm x 200 mm for cleanouts 2 NPS and smaller 300 mm x 300 mm for cleanouts 3 NPS and larger.

.2 Painted walls: Provide prime coated covers as specified in Section 21 05 01 Common Work Results for Mechanical – Access Doors.

.3 Feature walls: Avoid covers on feature walls; i.e.: wood panels. If unavoidable, the covers shall be for painted walls but with finish material secured to the cover to the satisfaction of the Departmental Representative and finished flush with wall.

.4 Access doors in fire rated walls shall be fire rated to match the wall rating.

END OF SECTION

1. GENERAL

1.1 Section Scope

.1 Thermal insulation and jacketing for plumbing piping and plumbing piping accessories.

1.2 Related Requirements

.1 This section of the Specification forms part of the Contract Documents and is to be read, interpreted and coordinated with all other parts.

.2 Section 21 05 01 – Common Work Results for Mechanical.

1.3 References

.1 The latest revisions of the following standards shall apply unless noted otherwise.

.2 Applicable Building Code - Refer to Section 21 05 01- Common Work Results for Mechanical.

.3 Applicable energy code or standard – Refer to Section 21 05 01 – Common Work Results for Mechanical.

.4 Thermal Insulation Association of Canada (TIAC) – National Insulation Standards.

.5 British Columbia Insulation Contractors Association (BCICA) – Quality Standard for Mechanical Insulation Manual.

.6 CAN/ULC S102-M88 – Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.

.7 ASTM C547 - Standard Specification for Mineral Fiber Pipe Insulation.

.8 ASTM C553 – Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.

1.4 Submittals

.1 Comply with Division 01 – Submittal Procedures and Closeout Procedures, Section 21 05 01 Common Work Results for Mechanical – Submittals and in addition the following:

.1 Certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.2 Manufacturer's installation instructions.

1.5 General Requirements

.1 The Installation firm shall be a current member of one of the following:

.1 Thermal Insulation Association of Canada (TIAC).

.2 British Columbia Insulation Contractors Association (BCICA).

.2 Only Journeyman insulation applicators, with 3 years minimum successful experience in this size and type of project, shall perform the work.

.3 Definitions:

.1 "CONCEALED" insulated mechanical services in trenches, chases, furred spaces, shafts and hung ceilings (services in tunnels are not considered to be concealed.)

.2 "EXPOSED" will mean not concealed.

.3 “K” value means Thermal Conductivity.

.4 UL GREENGUARD: Provides independent third-party, Indoor Air Quality (IAQ) certification of products for emissions of respirable particles and Volatile Organic Compounds (VOC's) and other specific product-related pollutants. Certification is based upon criteria used by Environmental Protection Agency (EPA), Occupational Safety and Health Organization (OSHA) and World Health Organization (WHO).

.5 ASJ: All Service Jacket composed of aluminum foil reinforced with glass scrim bonded to a kraft paper.

.6 SSL: Self-Sealing Lap.

.7 FSK: Foil Scrim Kraft; jacketing.

.8 PSK: Poly Scrim Kraft; jacketing.

.9 PVC: PolyVinyl Chloride.

.4 Provide thermal insulation on all new plumbing piping, valves and fittings as follows:

.1 Domestic cold water.

.2 Domestic hot water and recirculation (where applicable).

.3 All piping provided with heat tracing cable for freeze protection, and domestic hot water temperature maintenance.

.4 Provide foil faced flexible insulation on components requiring adjustment or servicing including meter sets, pressure reducing valves, valve bodies, strainers etc.

.5 Sanitary vent stacks for the last 3m prior to penetrating the roof or penetrating into a cold attic or similar space.

.5 If the Contractor, during renovations, should discover asbestos (or material suspected to be asbestos) on piping, ductwork, etc., he shall immediately cease all work in that area and contact Departmental Representative.

.6 Make good all existing insulation disturbed or removed to facilitate alterations and additions to existing piping

2. PRODUCTS

2.1 General

.1 Products shall not contain asbestos, lead, mercury, mercury compounds or Polybrominated diphenyl ethers (PBDE).

.2 Mineral fibre specified includes glass wool and rock wool.

.3 Thermal conductivity ("k" factor) not to exceed specified values when tested in accordance with ASTM C547.

.4 Insulation and jacketing materials shall not exceed 25 flame spread, 50 smoke developed rating when tested in accordance with CAN/ULC S102-M88 and NFPA 90A.

.5 Insulation for PP-R piping shall be sized to fit the outer dimensions of the metric pipe sized piping system in lieu of standard NPS.

.6 Glass mineral wool products shall have a recycled content of a minimum of 50 percent recycled glass content.

.7 Low Emitting Materials: For all thermal and acoustical applications of glass mineral wool insulation, insulation shall be UL GREENGUARD Certified.

2.2 Preformed Pipe Covering

.1 Piping Thermal Insulation:

.1 Piping service temperature 0°C to 315°C.

.2 Preformed insulation, formed glass mineral wool pipe insulation with all service jacket vapour retarder (ASJ). ASJ shall be re-enforced with glass fibre, factory applied with pressure sensitive lap closure.

.3 ASJ vapour transmission rate 0.02 perms maximum.

.4 “K” value at 24°C = 0.033 W/m.°C.

2.3 Blanket Insulation

.1 Piping Thermal Insulation:

.1 Piping service temperature 0°C to 315°C.

.2 Flexible, glass mineral wool blanket insulation, all service aluminum foil vapour retarder (FSK). FSK shall be reinforced with glass fibre and factory applied.

.3 “K” value at 24°C = 0.035 W/m.°C.

2.4 Fastenings, Adhesives and Coatings

.1 Insulation Fastenings: min. 1.6 mm thick galvanized wire, 0.6 mm thick aluminium wire, 0.6 mm thick type 304 stainless steel wire or 1.6 mm thick copper wire as commercially available.

.2 Jacket Fastenings:

.1 Thermocanvas and All Service Jacket:

.1 Staples (flare type), compatible jacket finishing tape, contact adhesives recommended by the jacket manufacturer.

.2 Metal Jackets:

.1 Sheet metal screws, pop rivets, stainless steel bands.

.3 PVC Jacket and Fitting Covers:

.1 PVC self-adhesive tape, plastic pop rivets, bonding cement.

.3 Adhesives:

.1 Fabric adhesive to insulation pipe covering, water based, ultra-white, washable, anti-microbial.

.4 Coatings:

.1 Vapour barrier coating on reinforcing membrane or on insulating cement:

2.5 Finish Jackets

.1 Jackets:

.1 Thermocanvas Jacket: fire rated, 170g fire retardant canvas jacket for covering mechanical insulation indoors, 25/50 fire class, plain wave cotton, no dyes.

.2 All Service Jacket: high puncture and tear resistance with 0.03 mm minimum thick foil. Water vapour permeance of 0.02 perms maximum. Self-adhesive material, flame spread/smoke development rating not to exceed 25/50.

.3 PVC Finishing Jacket: white, UV resistant, for indoor or outdoor applications, 25/50 fire class, minimum 0.50 mm thick.

.4 Aluminum Jacket: 0.51 mm thick stucco or smooth aluminum jacketing with longitudinal slip joints and 50mm end laps with factory applied protective liner on interior surface.

.2 Preformed Fitting Covers:

.1 PVC Fitting Covers pre-moulded one piece covers, white, UV resistant, for indoor or outdoor applications, 25/50 fire class, minimum 0.50 mm thick.

.2 Aluminum Fitting Covers: Die shaped components with factory applied protective liner on interior surface, 0.51 mm thick.

3. EXECUTION

3.1 General

.1 Install in accordance with Thermal Insulation Association of Canada (TIAC) National Standards.

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

.3 Pressure testing of piping systems and adjacent equipment to be complete, witnessed and certified prior to insulation installation.

.4 Use two layers of preformed insulation with staggered joints when the required nominal wall thickness exceeds 75 mm.

.5 Maintain uninterrupted continuity and integrity of vapour retarder jacket and finishes.

.6 Install hangers, supports outside vapour retarder jacket.

.7 Apply high compressive strength insulation, suitable for service, at oversized saddles and shoes where insulation saddles have not been provided.

.8 Ensure insulation is continuous through inside walls. Pack around pipes with fire proof self-supporting insulation material, properly sealed.

.9 Insulate piping, fittings and valves. Do not insulate unions, flanges (except on flanged valves), roll groove couplings, strainers, flexible connections and expansion joints. Terminate insulation neatly with plastic material trowelled on a bevel.

.10 Locate insulation or cover seams in least visible locations. Locate seams on piping in ceiling spaces on the underside of the pipe.

.11 Roof Drains and Vents: Adhere flexible blanket insulation with adhesive applied to all laps. Provide annealed tie wire at 400mm centres for securing insulation. Butt insulation and seal joints and breaks with 50mm wide foil adhered over joint.

.12 Do not insulate exposed run-outs local to a plumbing fixture, chrome plated piping, valves, fittings. Do not insulate run-outs to individual units and equipment not exceeding 3600 mm long.

.13 Where insulation is not specified:

.1 Hot Piping: Coat exposed hot pumps, pipe and fittings with Therma-Lite liquid insulation product to prevent skin burns

.2 Cold Piping: Coat exposed cold pumps, pipes, and fittings, connecting surfaces of thermometers, pressure gauges, flow switches, controllers, etc. with a No Sweat paint product to prevent condensation.

3.2 Polypropylene Piping

.1 PP-R pipe and fittings are an insulated pipe system rated for flame and smoke development performance. The product must be wrapped with an insulation with ASJ of a minimum thickness 12mm that is listed and labelled to comply with CAN/ULC 102 flame spread and smoke developed ratings equal or less than 25 and 50 respectively.

.2 All joints and couplings in the PP-R pipe must be completely covered by insulation. Joints in the insulation must be taped with a self-sealing insulation tape certified for use with a listed and labelled pipe insulation compliant with CAN/ULC S102 flame spread and smoke developed ratings equal or less than 25 and 50 respectively. The tape must be installed in accordance with the manufacturer's instructions.

.3 Comply with application thickness table for insulation thickness or 12mm thick whichever is the greater.

3.3 Installation Cold Application - (5°C to 15°C) 1501-C

.1 Piping: Apply pipe insulation with integral vapor retarder jacket to piping and hold in place by securing the jacket flap. Seal all flaps and butt strips with vapor retarder adhesive. Pipe insulation with integral self-sealing vapor retarder jacket will not require additional fastening.

.2 Screwed or welded fittings: Insulate fittings with section of the pipe insulation mitered to fit tightly. All seams shall be sealed using vapor retarder tape.

.3 Valves, Strainers: Insulate valve bodies, bonnets and strainers with fitted pipe insulation or mitered blocks all to thickness of adjacent pipe insulation, then seal all seams of vapor retarder with vapor retarder tape.

.4 Flanged and grooved fittings: Insulate with oversized pipe insulation or mitered blocks to the thickness of the adjacent pipe insulation, then seal all seams of vapor retarder jacket with vapor retarder tape.

3.4 Installation Hot Application - Intermediate Temperature (15°C - 315°C) 1501-H

.1 Piping: Pipe covering without integral jacket shall be held in place with insulation fastening at not less than 300 mm centres. Pipe insulation with integral jacket shall be held in place by stapling the flap on 75 mm centres. Pipe insulation with integral self-sealing jacket will not require additional fastening.

.2 Screwed or welded fittings: Insulate fittings with sections of the pipe insulation mitered to fit tightly, or with tightly placed flexible insulation covered with reinforcing membrane stapled in place. Alternately insulate fittings with tightly placed flexible insulation and apply PVC fitting covers.

.3 Valves, Strainers: Insulate valve bodies and strainers with fitted pipe insulation segments, or mitered blocks all to thickness of the adjacent pipe insulation. Drains, blow off plugs and caps shall be left uncovered. Alternately insulate with tightly placed flexible insulation and apply PVC fitting covers.

.4 Flanged and grooved fittings: Insulate with oversized pipe covering or mitered blocks to the thickness of the adjacent pipe covering. Alternately insulate with tightly placed flexible insulation and apply PVC fitting covers.

.5 Insulation Termination Points: Terminate insulation 75mm from fittings to provide working clearance and bevel insulation at 45° angle.

3.5 Finishes

.1 Concealed piping shall be left as factory finished, TIAC standard CPF/2.

.2 Exposed Piping Indoor (Canvas) CPF/1:

.1 The factory applied integral all service jacket shall be neatly applied to receive the fabric jacket. Apply a jacket with a fire resistive lagging coating. Apply a finishing coat of fire resistive lagging coating.

.3 Exposed Piping Indoor (PVC Jacket) CPF/4:

.1 Apply PVC jacketing using necessary fastenings on approximately 300mm centers, or bond using an adhesive recommended by the manufacturer to provide continuous seal. Overlap each section a minimum 75mm. Cover longitudinal and circumferential joints with finishing tape neatly applied. On hot piping tacks may be used to secure jacket laps. Tacks are to be applied on 100mm centres.

.2 Over insulated fittings, valve bodies, valve bonnets, strainers and flanges apply PVC jacket or preformed PVC fitting covers to provide a complete jacket system. Secure with appropriate fastenings and jacket finishing tape.

3.6 Application Design Operating Temperatures

.1	Continuous Cold Water Drainage	10°C
.2	Drip Pan Drain – Unit Cooler	Insulation Not Required
.3	Drip Pan Drain – Evaporator 11°C & Above	Insulation Not Required
.4	Drip pan drain – Evaporator Below11°C	10°C
.5	Domestic Cold Water	10°C
.6	Domestic Hot & Tempered Water	60 - 80°C
.7	Self-Regulated Heater Traced DHW Piping	60°C
.8	Interior Storm Drainage	10°C

3.7 Application Thickness Table

Type of System	**Design Operating Temperature Range °C**	**Thermal Conductivity of Insulation**		**Nominal Pipe Diameter NPS**				
		Conductivity Range W/m.°C	**Mean Rating Temperature °C**	Runouts ≤ 1	≤ 1	1-1/4 to 2	2-1/2 to 4	≥ 5
				Minimum Thickness of Piping Insulation (mm)				
Unconditioned space or outside	All	0.046-0.049	38	40	65	65	75	90
Hot Water Systems	61-93	0.035-0.040	38	25	25	25	40	40
	41-60	0.035-0.040	38	25	25	25	40	40

Cold Water Systems	5-16	0.030-0.039	24	25	25	25	25	25
	<5	0.030-0.039	24	25	25	40	40	40

Note: Where the thermal conductivity of a proposed insulation is greater than the range specified above, the thickness will be increased by the ratio of U2/U1.

U2 = proposed insulation “k” value at the table mean rating temperature.

U1 = upper range limit “k” value from the table above.

Note: Where thermal conductivity of proposed insulation is less than the range specified above, the thickness may be decreased by the ratio of U2/U1.

U2 = proposed insulation “k” value at the table mean rating temperature.

U1 = lower range limit “k” value from the table above.

3.8 Piping Finish Schedule

.1 Conform to the following:

Duty	Type	TIAC Code
Indoors, concealed	Factory	CPF/2
Indoors, exposed in utility areas	Canvas Jacket	CPF/1
Indoors, exposed elsewhere	PVC Jacket	CPF/4
Outdoors	Metal Jacket	CPF/3

3.9 Scope of Work

.1 Insulate all new domestic water pipes downstream from point of tie-in to existing pipes. Refer to drawings.

END OF SECTION

1. GENERAL

1.1 Summary

.1 This section includes materials and installation for domestic cold, domestic hot and domestic hot water recirculation systems including all piping, fittings, valves and equipment inside the building to 915mm outside the building.

1.2 Related Sections

.1 This section of the specification forms part of the Contract Documents and shall be read interpreted and coordinated with all other parts of the Contract Documents.

.2 Section 21 05 01 Common Work Results for Mechanical.

.3 Section 23 05 29 Hangers and Supports for Mechanical Piping and Equipment.

.4 Section 23 05 48 Vibration and Seismic Control for Mechanical.

.5 Section 23 05 53 Identification for Mechanical Piping and Equipment.

.6 Section 23 05 93 Testing, Adjusting and Balancing for HVAC.

1.3 References

.1 Applicable Building and Plumbing Code - Refer to Section 21 05 01.

.2 Canadian Standards Association (CSA Group).

.1 CSA-B64 Series 11 (R2016), Backflow Preventers and Vacuum Breakers.

.2 CSA B64.10.1 - Selection and Installation of Backflow Preventers/Maintenance and Field Testing of Backflow Preventers.

.3 CSA B137.5 – Crosslinked Polyethylene (PEX) Tubing Systems for Pressure Applications.

.4 CSA B137.11 - Polypropylene (PP-R) Pipe and Fittings for Pressure Applications.

.5 CSA-B356-10 (R2015), Water Pressure Reducing Valves for Domestic Water Supply Systems.

.3 Plumbing and Drainage Institute (PDI).

.1 PDI-WH201 (Revised 2010), Water Hammer Arrestors Standard.

.4 American Society of Mechanical Engineers (ASME)

.1 ASME B16.5 – Pipe Flanges and Flanged Fittings: NPS ½ Through NPS 24 Metric /Inch Standard.

.2 ASME B16.9 - Factory-Made Wrought Buttwelding Fittings.

.3 ASME B16.15 - Cast Bronze Threaded Fittings, Classes 125 and 250.

.4 ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings.

.5 ASME B16.22 - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.

.5 American Society for Testing and Materials International, (ASTM).

.1 ASTM A351/A 351M – Castings, Austenitic for Pressure Containing Parts

.2 ASTM B88 - Standard Specification for Seamless Copper Water Tube.

.3 ASTM F876 – Stanard Specification for Crosslinked Polyethylene (PEX) Tubing.

.4 ASTM F877 – Standard Specification for Crosslinked Polyethylene (PEX) Plastic Hot and Cold Water Distribution Systems.

.5 ASTM F1960 – Standard Specification for Cold Expansion Fittings With PEX Reinforcing Rings for Use With Crosslinked Polyethylene (PEX) Tubing.

.6 ASTM F 2389-06 - Standard Specification for Pressure-rated Polypropylene (PP) Piping Systems.

.6 American Water Works Association (AWWA).

.1 AWWA C606 – Standard for Grooved and Shouldered Joints.

.2 AWWA C904 – Crosslinked Polyethylene (PEX) Pressure Pipe ½ In. (12mm) through 3” (75mm) for Water Service.

.7 Manufacturer's Standardization Society of the Valve and Fittings Industry (MSS).

.1 MSS SP 70 - Cast Iron Gate Valves, Flanged and Threaded Ends.

.2 MSS SP 71 - Cast Iron Swing Check Valves, Flanged and Threaded Ends.

.3 MSS SP 80 - Bronze Gate, Globe, Angle and Check Valves.

.8 Plumbing and Drainage Institute (PDI).

.1 PDI-WH201 (Revised 2010), Water Hammer Arrestors Standard.

.9 National Sanitation Foundation (NSF):

.1 NSF/ANSI 14 Plastic Piping System Components and Related Materials

.2 NSF/ANSI 61 Drinking Water System Components – Health Effects.

.10 Underwriters’ Laboratories of Canada Inc:

.1 CAN/ULC-S101 Standard Methods of Fire Endurance Tests of Building Construction and Materials.

.2 CAN/ULC-S115 Standard Method of Fire Tests of Firestop Systems.

.3 CAN/ULC-S102.2 Standard for Surface Burning Characteristics of Flooring, Floor Covering and Miscellaneous Materials and Assemblies.

.11 Plastic Pipe Institute (PPI):

.1 PPI Technical Report TR-4.

1.4 Waste Management and Disposal

.1 Separate waste materials for reuse and recycling in accordance with Section 01 74 21 – Construction/Demolition Waste Management and Disposal.

.2 Remove from site and dispose of packaging materials at appropriate recycling facilities.

.3 Place materials defined as hazardous or toxic in designated containers.

.4 Fold up metal banding, flatten and place in designated area for recycling.

1.5 Quality Assurance

.1 All materials shall comply with manufacturer’s specifications and referenced documents.

.2 All roll grooved joint couplings, fittings, valves and specialties shall be manufactured by the same manufacturer including roll grooving tools used.

.3 The installer of the piping system shall be qualified, licensed within the jurisdiction and familiar with the installation of the type of pipe or tube being installed.

.4 To comply with the manufacturer's warranty requirements, confirm with the manufacturer the style or model number of couplings, dielectric connections, stainless steel bolted branch outlets, expansion compensators, valves, flange adaptors and accessories to suit pipe material and diameters.

1.6 Submittals

.1 Submittals in accordance with Section 01 33 00 – Submittal Procedures.

.2 Product Data:

.1 Submit manufacturer's printed product literature, specifications and datasheets for fixtures and equipment.

.2 Indicate dimensions, performance, construction details and materials for specified items.

.3 Shop Drawings:

.1 Submit shop drawings to indicate materials, finishes, method of anchorage, dimensions, construction and assembly details and accessories for the following:

.1 Valves

.2 Domestic Water Pipe, Fittings and Insulation

.3 Mechanical and Press Fit Type Couplings and Gaskets

.4 Vacuum Breakers

.5 Water Hammer Arrestors

.6 Relief Valves

.7 Check Valves

.8 Hose Bibbs

.9 Trap Seal Primers

.10 Water Filters

.4 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.5 Instructions: submit manufacturer's installation instructions.

.6 Closeout submittals: submit maintenance and engineering data for incorporation into maintenance manuals.

1.7 Pipe, Fittings and Couplings

.1 Provide for all pipe, fittings, couplings, valves, nipples, drains and all accessory pipe work for a complete installation within the base tender price.

.2 No extra cost will be considered based on failure of the contractor to allow for pipe, fittings and pipe work as required during construction to provide offsets to avoid structural components, and to coordinate with other piping services, ductwork, cable trays, conduits or other obstacles whether indicated on the drawings or not.

1.8 Seismic Protection

.1 Comply with Section 23 05 48 – Vibration and Seismic Control for Mechanical.

1.9 Substantial & Total Performance

.1 Comply with Section 21 05 01 Common Work Results for Mechanical – Substantial and Total Performance.

2. PRODUCTS

2.1 Pipe Hangers and Supports

.1 Comply with Section 23 05 29 – Hangers and Supports for Mechanical Piping and Equipment.

.2 Vertical piping shall be supported at its base and at the floor level of alternate storeys, unless otherwise recommended by pipe manufacturer, by rests that can support the weight of the pipe that is between it and the rest above it. Maximum spacing of vertical supports shall be 7.5 m or less if recommended by pipe manufacturer and to comply with seismic requirements.

2.2 Miscellaneous Metal Related to Domestic Water Systems

.1 All miscellaneous metal related to the facility water distribution systems including all metal back up plates, stands, brackets and supports for all roof, floor or wall supported equipment and piping systems is part of this Section of the Work.

.2 Provide two coats of heavy red oxide primer to all steel components after fabrication, and touch up on site after installation.

2.3 Piping General

.1 Installation shall be in accordance with the manufacturer’s installation instructions.

2.4 Buried Pipe and Fittings Inside the Building

.1 75 mm and smaller.

.1 Type 'K' seamless soft annealed copper tubing to ASTM B88 or copper pipe to ASTM B42. Provide in long lengths and with no buried joints. All piping shall be encased in a polyethylene piping system.

.2 Polypropylene Pipe and Fittings (PP-R):

.1 See specification for above ground pipe and fittings.

2.5 Above Ground Water Pipe Inside the Building

.1 **Copper Piping Systems**

.1 Pipe and fittings:

.1 Cold and hot water:

.1 Type ‘L’ hard drawn seamless copper tubing to ASTM B88 or copper pipe to ASTM B42.

.2 Type ‘K’ hard drawn seamless copper tubing to ASTM B88 or copper pipe to ASTM B42.

.2 Cast brass or wrought copper solder joint pressure fittings with 95/5 Sn/Sb or Silvabrite 100 solder joints.

.3 Push to Connect Fittings:

.1 Suitable for use with copper tubing and certified to NSF/ASNI 61, NSF/ASNI 14 and ASSE 1061 for use with potable water.

.2 Lead free DZR brass body, EPDM O-ring, stainless steel grab ring.

.3 Maximum working pressure of 1,379 kPa and maximum temperature of 93° C.

.4 Pressure joint fittings for 1 NPS and smaller, cast copper joint with 301 stainless steel internal components and EPDM seals, complying with ASME B16.18. Suitable for operating pressure to 1380 kPa.

.2 **Crosslinked Polyethylene (PEX) Pipe and Fittings**

.1 Pipe and fittings:

.1 High density crosslinked polyethylene (PEX-a) conforming to ASTM F876, ASTM 877, ASTM F1960 and CSA B137.5.

.2 All PEX tubing fittings and fitting assemblies shall be by one manufacturer.

.3 Pipe shall be rated for continuous operation of 690 kPa @ 82° C, and 550 kPa @ 93° C.

.4 CAN/ULC S102.2 listed for flame spread and smoke developed rating of 25/50.

.5 CAN/ULC S115 Standard Method of Fire Tests of Firestop systems.

.6 PEX pipe to have a UV protective coating of UV resistant material.

.7 Manufacturer’s warrantry shall be twenty five (25) years on pipe and fittings.

.8 Fittings shall be in accordance with ASTM F877, ASTM F1960 and CSA B137.5 and approved by the manufacturer’s PEX piping system, with applicable plumbing and mechanical code certifications. Fittings shall be lead free.

.9 Distribution manifolds shall be copper Type L, NSF 61 certified.and supplied by the piping manufacturer.

.10 Copper and/or brass outlets shall be high temperature brazed (lead free) into headers.

.2 Pipe joints:

.1 PEX joints shall be to ASTM F1960 Cold Expansion Fittings with PEX Reinforcing Rings for Use with Crosslinked Polyethylene (PEX) Tubing and as approved by the manufacturer of the PEX piping system.

.2 Provide dielectric connections between dissimilar metals. Dielectric fittings complete with thermoplastic and complying to ASTM F492.

.3 **Chlorinated Polyvinyl Chloride Pipe (CPVC):**

.1 4 NPS and smaller.

.2 Solvent weld SDR11 CPVC piping conforming to CSA B137.6 for potable water use.

.3 All CPVC tubing, fittings and fitting assemblies shall be by one manufacturer.

.4 Pipe shall be rated for continuous operation of 1304 kPa @ 71°C.

.5 CAN/ULC S102.2 listed for flame spread and smoke developed rating of 25/50.

.6 CPVC pipe to have a UV protective coating of UV-resistant material.

.7 Fittings in compliance with CSA B137.6 and approved by the manufacturer's CPVC piping system, with applicable plumbing and mechanical code certifications.

.8 Fittings wall thickness shall meet minimum requirements for SDR11.

.9 CPVC joints: 2 part solvent weld. Cements and primers shall comply with CSA B137.6 for use with CPVC pipe in potable water systems. Cements shall be low VOC type.

.4 **Polypropylene Pipe and Piping Products**

.1 In conformance with CSA-B137.11, Polypropylene (PP-R) and Fittings for Pressure Applications.

.2 Pipe shall be suitable for potable water use and manufactured from a PP-R resin meeting the short-term properties and long-term strength requirements of ASTM F 2389. The pipe shall contain no rework or recycled materials except that generated in the manufacturer's own plant from resin of the same specification from the same raw material. All pipe shall be made in an extrusion process. Pipe for use in domestic hot water and domestic hot water recirculation systems shall contain a fiber layer (faser) to restrict thermal expansion. All pipe shall comply with the rated pressure requirements of ASTM F 2389. All pipe shall be certified by NSF International as complying with NSF 14, NSF 61 and ASTM F 2389 or CSA B137.11.

.3 Fittings shall be manufactured from a PP-R resin meeting the short-term properties and long-term strength requirements of ASTM F 2389. The fittings shall contain no rework or recycled materials except that generated in the manufacturer's own plant from resin of the same specification from the same raw material. All fittings shall be certified by NSF International as complying with NSF 14, NSF 61 and ASTM F 2389 or CSA B137.11.

.4 PP-R joints: Socket-fusion, electro-fusion, or butt-fusion as applicable for the fitting type. Fusion-weld tooling, welding machines, and electro-fusion devices shall be as specified by the pipe and fittings manufacturer. Fusion-weld tooling, welding machines, and electro-fusion devices shall be as specified by the pipe and fittings manufacturer.

.5 Warranty:

.1 Manufacturer shall warrant pipe and fittings for 10 years to be free of defects in materials or manufacturing.

.2 Warranty shall cover labor and material costs of repairing and/or replacing defective materials and repairing any incidental damage caused by failure of the piping system due to defects in materials or manufacturing.

.3 Warranty shall be in effect only upon submission by the contractor to the manufacturer of valid pressure/leak test documentation indicating that the system was tested and passed the manufacturer's pressure/leak test.

.6 Valves:

.1 Valves shall be manufactured in accordance with the manufacturer's specifications and shall comply with the performance requirements of ASTM F 2389 or CSA B137.11. The valves shall contain no rework or recycled thermoplastic materials except that generated in the manufacturer's own plant from resin of the same specification from the same raw material.

.7 Smoke and fire ratings:

.1 Provide Plenum-rated Piping System; where all piping on this project shall be wrapped and/or insulated with standard pipe insulation, field installed. The pipe wrap or insulation shall meet the requirements of CAN/ULC-S102.2-03 or ASTM E84. The system shall have a Flame Spread Classification of less than 25 and Smoke Development rating of less than 50.

.8 Pipe insulation:

.1 Pipe insulation used on pipe and fittings shall be as recommended by the pipe manufacturer.to achieve a flame spread classification of less than 25 and smoke development rating of less than 50.

.9 UV protection:

.1 Where indicated on the drawings that the pipe will be exposed to direct UV light for more than 30 days, it shall be provided with a factory applied, UV-resistant coating or alternative UV protection.

.10 Thermal and vapor barrier:

.1 Where standard pipe insulation is indicated on the drawings or in these specifications, the contractor shall provide a thermal (radiant, conductive, and convective) and vapor barrier insulation. The insulation products shall be provided as indicated in specification section 22 07 19 Plumbing Piping Insulation. The standard pipe insulation shall be UV resistant, CFC-free, non-porous, non-fibrous, and resist mold growth.

2.6 Valves

.1 Valves shall conform to NSF 61/372.

.2 Gate: (for shut-off and isolation)

.1 50 mm and smaller, bronze body, solid wedge disc, bronze or stainless steel trim, non-rising stem, 860 kPa rating.

.3 Ball: (in lieu of gate valves or as specified)

.1 50 mm and smaller, brass two piece body, blow-out proof stem, PTFE seats, brass chrome plate ball, lever handle operator, 1035 kPa rating.

.4 Check: (for horizontal installation)

.1 50 mm and smaller, threaded joint type, bronze body, bronze or stainless steel swing disc holder with Teflon disc, 860 kPa rating.

.5 Pressure reducing:

.1 Direct acting water pressure reducing valves for domestic water supply systems shall conform to CSA-B356 - Water Pressure Reducing Valves for Domestic Water Supply Systems.

.2 25 mm and smaller: Bronze body, SS integral strainer, renewable SS seat, high temperature rated diaphragm suitable for hot and cold water. Rated at maximum inlet pressure of 2100 kPa.

.6 Drain Valves and Hose Bibbs:

.1 Hose Bibbs: Lockshield globe type with bronze body and trim suitable for maximum system operating pressure.

.2 Drain Valves: Ball type with brass body, cap & chain and chrome plated brass ball.

.7 Thermostatic Mixing Valves:

.1 Point of use lavatory tempering valve:

.1 Adjustable temperature selection, tamper proof, lead free brass body, internal checks with screens, rough bronze finish and complying with CSA B125.

.2 Maximum pressure 861 kPa.

.3 Inlet range hot: 49 - 82°C, cold: 4 -27°C, temperature adjustment 27 - 49°C.

.4 Minimum flow 1 Lpm single duty, 2 Lpm up to 2 lavatories.

.5 $^{3}/_{8}$ NPS compression for single lavatory application.

.6 ½ NPS screwed for two (2) lavatory application.

2.7 Vacuum Breakers

.1 Pressure type:

.1 CSA approved, mechanically independent spring loaded poppet type check valve with a downsteam spring loaded air inlet valve, with upstream and downstream isolation valves and test cocks.

.2 Atmospheric type:

.1 CSA approved, bronze body, chrome plate finish where exposed.

.3 All vacuum breakers shall be sized in accordance with the following table:

Pipe Size mm	Pressure Type Size mm	Atmospheric Type Size
12 - 25	12	Full Pipe Size

2.8 Water Hammer Arrestors

.1 Bellows or piston manufactured style with stainless steel casing and welded stainless steel nesting bellows if of the bellows style. Site fabricated air chambers are unacceptable.

2.9 Temperature and Pressure Relief Valves

.1 Design: A.S.M.E. rated for the energy input to the system and the pressure rating of the equipment.

2.10 Pipe Joints

.1 Solders and fluxes having a lead content and self cleaning acid type fluxes shall not be used.

.2 All copper to steel or iron and flanged adaptors shall be brass, not copper.

.3 All unions or similar interconnections between dissimilar metals shall be dielectric couplings.

3. EXECUTION

3.1 Examination

.1 The installing contractor shall examine the pipe/tube and fittings for defects or cracks. There shall be no defects of the pipe/tube and fittings. Any damaged pipe/tube and fittings shall be rejected.

3.2 General Piping Installation

.1 Unless otherwise noted, pipe hangers and supports shall be as required by Section 23 05 29 – Hangers and Supports for Mechanical Piping and Equipment.

.2 Provide allowance for thermal expansion and contraction of piping passing through a wall, floor ceiling or partition.

.3 Piping shall be installed such that it is not in contact with building members.

.4 All off site prefabrication of piping shall be at the contractor’s own risk.

.5 Install piping to maximize headroom in all areas, including exposed installations. Co-ordinate space requirements with other installation Contractors.

.6 Combustible pipe shall not be installed in vertical shafts.

.7 Comply with hanger and supports requirements of the manufacturer for all combustible piping. Where the manufacturers recommendations conflict with Section 23 05 29 Hangers and Supports for Mechanical Piping and Equipment, the more stringent shall apply.

.8 Installation shall be in accordance with the applicable building and plumbing codes and local authority having jurisdiction.

.9 Install piping free of sags, bends and kinks.

.10 Remove scale, slag, dirt and debris from inside and outside of pipe and fittings before assembly.

.11 Threaded joints shall have teflon tape applied to the male threads only. Tighten joint with a wrench and backup wrench as required.

.12 Assemble piping using fittings manufactured to noted standards. Installation shall also be to the manufacturer’s recommendations.

.13 Connect to fixtures and equipment shall be in accordance with manufacturer's written instructions unless otherwise indicated.

.14 Provide dielectric connections between dissimilar metals. Dielectric fittings complete with thermoplastic liner and complying ASTM F492.

.15 Where a hanger or support for pipe or tube is of a dissimilar metal it shall be suitably separated and electrically insulated from the pipe or tube.

.16 Joints in copper tubes installed underground shall be made with either flared or compression fittings or be brazed using a brazing alloy within the American Welding Society’s AWS-BCuP range. Compression fittings shall not be used underground under a building.

.17 For press type and push to connect fittings, the insertion depth and installation methods shall comply with the fitting manufacturer's recommendations. For press to connect fittings, provide to Departmental Representative one disconnect clip for each size of fitting installed.

3.3 Concealed Supply Piping

.1 Concealed water supply piping to plumbing fixtures, trim items, equipment, hose bibbs, etc. shall be installed using cast brass 90 degree drop ear elbow or drop ear tees as the piping design dictates.

.2 Blocking shall be provided within the concealed space and the elbows and tees shall be secured to the blocking using brass screws to provide a rigid installation.

3.4 Crosslinked Polyethylene (PEX) Pipe

.1 Installers shall be trained and certified by the manufacturer to install pipe and fittings according to the manufacturer's guidelines.

.2 All expansion tools used with cold expansion fittings shall be as recommended by the fitting manufacturer.

.3 Installers shall comply with the manufacturer's technical guidelines including but not limited to technical manuals installation guides, technical bulletins and product submittals.

.4 The minimum bend radius for cold bending of the pipe shall be not less than six (6) times the outside diameter. Bends with a radius of less than this shall require a bending template as suppled by the pipe manufacturer.

.5 Where fittings are encased in concrete or buried underground, fittings shall be wrapped as per manufacturer's recommendations to protect the material.

.6 Piping that passes through expansion joints or walls shall be covered in protective polyethylene convoluted sleeving (flexible conduit) extending 400mm on each side of the joint. Secure sleeving on pipe to prevent movement during installation.

.7 Provide a protective conduit around the pipe when entering wall. Extend 150mm either side of entry. For penetrations at manifolds, use rigid PVC bend guides.

.8 PEX tubing passing through metal studs shall be used with grommets or sleeves at the penetration.

.9 Manufacturer's wall penetration brackets shall be used at all wall membrane penetrations.

.10 Hangers and support spacing shall be as recommended by the pipe manufacturer and the applicable building/plumbing code.

3.5 Chlorinated Polyvinyl Chloride Pipe (CPVC):

.1 Installers must comply with manufacturers technical guidelines, including but not limited to technical manuals, installation guides, technical bulletins and product submittals.

.2 Follow manufacturer's acceptable products recommendations for chemical compatibility of fire stop material and thread sealants with CPVC.

3.6 Polypropylene Pipe

.1 Install listed pipe materials and joining methods below in the following applications:

.1 Underground Piping: Polypropylene (PP-R) piping in SDR 7.4,11, or 17.6 per manufacturer's instructions and ASTM D2774.

.2 Aboveground: Polypropylene (PP-R) piping in SDR 7.4 only is acceptable on this project, based on the required minimum pressure rating and use temperature, in accordance with manufacturer's instructions and ASTM F2389.

.2 Fusion Welding of Joints

.1 Install fittings and joints using socket-fusion, electro-fusion, or butt-fusion as applicable for the fitting type. All fusion-weld joints shall be made in accordance with the pipe and fitting manufacturer's specifications and product standards.

.2 Fusion-weld tooling, welding machines, and electro-fusion devices shall be as specified by the pipe and fittings manufacturer.

.3 Prior to joining, the pipe and fittings shall be prepared in accordance with ASTM F 2389 and the manufacturer's specifications.

.4 Joint preparation, setting and alignment, fusion process, cooling times and working pressure shall be in accordance with the pipe and fitting manufacturer's specifications.

.3 Piping Installation

.1 Install hangers and supports at intervals specified in the applicable Plumbing Code and/or as recommended by pipe manufacturer.

.2 Support vertical piping at each floor and/or as specified in the applicable Plumbing Code. Piping 65mm and smaller shall be installed with mid-story guides.

.3 Fire stopping shall be provided to both be compatible with the Aquatherm Piping and meet the requirements of ASTM E 814 or ULC S115, "Fire Tests of Through-Penetration Firestops". Pipe insulations or fire resistive coating shall be removed where the pipe passes through a fire stop and, if required by the firestop manufacturer, for 3 inches beyond the firestop outside of the fire barrier.

.4 If heat tracing is specified for the piping, it should be installed on the pipe interior or exterior. It must be suitable for use with plastic piping and be self-regulating to ensure the surface temperature of the pipe and fittings will not exceed 70°C.

3.7 Valve Installation

.1 Where possible, disassemble solder end joint valves before soldering. Where disassembly and reassembly of the valves is impossible, the contractor shall give special regard to solder jointing in order not to damage, melt or deform any valve parts.

.2 Shut Off Valves:

.1 Install shut-off or isolation valves whether shown on the drawings or not at the following locations:

.1 At the base of each new building riser.

.2 At each new main branch supply point; provide a valve on each outlet leg from the tee or cross.

.3 At each single plumbing fixture (i.e. normally this requirement is satisfied by the provision of the angle valve specified with the specific fixture).

.4 At each single piece of equipment.

.5 At all points as indicated on the drawings.

.6 At all points where the plumbing code requires same.

.7 Close to the main on each new branch and riser serving two or more plumbing fixtures or equipment connections and where indicated.

.8 On the inlet to each new plumbing equipment item, on each supply to each new plumbing fixture not having stops on supplies, and elsewhere as indicated.

.3 Install swing check valves as indicated.

.4 Install shut off valves in each new hot-water circulating loop.

.5 Mixing Valves:

.1 In addition to check valves common to the mixing valves, provide, in an accessible location, a positive swing check valve and strainer on each of the hot and cold water supplies upstream of the mixing valve. Provide an access panel to the check valves and strainers where required.

.6 Balancing Valves:

.1 Install circuit balancing valves in hot water recirculating branch mains and branch connections to return mains whether indicated on drawings or not.

.2 Combination valves are not acceptable. Provide separate valve for isolation.

.7 Drain Valves:

.1 Install drain valves 20 mm minimum, or line size where the piping is smaller than 20 mm.

.2 Install a hose-end adaptor, cap and chain on the discharge side of each drain valve or pipe to drain where indicated.

.3 Install drain valves at the base of each new riser, at low points of horizontal runs, and where required to drain the water distribution piping system.

.8 Thermostatic Mixing Valves

.1 Point of use lavatory tempering valve:

.1 Provide a tempering valve to all lavatories with domestic water service in excess of 48°C and all lavatories served by automatic faucets.

.2 Tempering valve shall be concealed but accessible for service and adjustment.

.3 Tempering valve shall be adjusted to provide domestic hot water from 43°C to 48°C.

3.8 Flanges and Unions

.1 Provide on all connections to pumps, reducing valves, control valves, fixtures, and equipment.

.2 Connections up to and including 50 mm size shall be all bronze union, 1,035 kPa rating with ground seat; larger connections shall be flanged.

3.9 Pressure Gauges

.1 Install pressure gauge at all pump suction and discharge points and at each pressure reducing station inlet and outlet.

3.10 Water Hammer Arrestors

.1 Size in accordance with the Plumbing and Drainage Institute PD1-WH-201 sizing procedures.

.2 Install on branch lines to flush valves, solenoid valves, self-closing faucets, quick closing valves and on kitchen and laundry equipment incorporating solenoid valves.

3.11 Pipe Joints

.1 Install dielectric type couplings where copper piping and accessories connect to plumbing equipment such as steel storage tanks, pressure reducing stations.

.2 Provide flanges or unions on all connections to new reducing valves, control valves, fixtures, and equipment.

.3 Connections up to and including 2 NPS shall be all bronze union, 1,035 kPa rating with ground seat; larger connections shall be flanged.

3.12 Testing and Inspection

.1 Conform to the requirements of Section 21 05 01 Common Work Results for Mechanical

.2 Use only potable water for testing of potable water systems.

.3 Test pressure shall be the greater of 1.5 times maximum system operating pressure or 860 kPa.for 8 hours.

.4 Any leaks shall be corrected and the system retested.

3.13 Flushing and Cleaning of Water Lines

.1 Where flushing and cleaning of the piping only is required: The piping system shall be flushed with potable water from the municipal system at a minimum velocity of 1 m/s until the water is free of turbidity and discolored water does not appear at any of the outlets.

.2 For confirmation, bacteriological testing shall be performed by a reputable testing agency. Should bacteriological testing indicate contamination, flushing shall be repeated.

.3 Submit to the Departmental Representative a certificate from the testing agency stating that the bacteriological testing and flushing of the systems has been successfully completed and the test samples comply with the requirements.

3.14 Pre-Start-Up Inspections

.1 Systems to be complete, prior to flushing, testing and start-up.

.2 Verify that system can be completely drained.

3.15 Start-Up

.1 Timing: Start up after:

.1 Pressure tests have been completed.

.2 Flushing procedures have been completed.

.3 Certificate of static completion has been issued.

.2 Provide continuous supervision during start-up.

.3 Start-up procedures:

.1 Establish circulation and ensure that air is eliminated.

.2 Check pressurization to ensure proper operation and to prevent water hammer, flashing and/or cavitation.

.3 Bring hot water storage tank up to design temperature slowly.

.4 Monitor piping systems for freedom of movement and pipe expansion.

.5 Check control, limit, safety devices for normal and safe operation.

.4 Rectify start-up deficiencies.

3.16 Performance Verification

.1 Timing:

.1 After pressure and leakage tests and disinfection completed, and certificate of completion has been issued by authority having jurisdiction.

.2 Procedures:

.1 Verify that flow rate and pressure meet Design Criteria.

.2 Testing in accordance with Section 23 05 93 – Testing, Adjusting and Balancing for Mechanical.

.3 Adjust pressure regulating valves while withdrawal is maximum and inlet pressure is minimum.

.4 Verify performance of temperature controls.

.5 Verify compliance with safety and health requirements.

.6 Check for proper operation of water hammer arrestors. Run one outlet for 10 seconds, then shut of water immediately. If water hammer occurs, replace water hammer arrestor/s. Repeat for outlets and flush valves.

.7 Confirm water quality consistent with supply standards, verifying that no residuals remain as a result of flushing and/or cleaning.

.3 Reports:

.1 In accordance with Section 23 08 00 – Commissioning of Mechanical Systems.

.2 Include pressure tests conducted on incoming water service, demonstrating adequacy of flow and pressure.

END OF SECTION

1. GENERAL

1.1 Section Scope

.1 Sanitary drain waste and vent piping, equipment and accessories between plumbing fixtures to 1m from the building.

.2 Interior sanitary waste and vent piping shall be provided as depicted on the drawings to plumbing fixtures that will discharge sanitary waste and shall be connected to discharge to the existing sanitary waste piping as depicted on the drawings.

1.2 General Requirements

.1 All buried sanitary drain and waste piping shall be a minimum of 3 NPS.

.2 Buried sanitary drain and waste piping shall be one size larger than the above ground size up to 4 NPS

.3 Like product and materials shall be of one manufacturer.

.4 Non-functioning existing interior sanitary waste piping shall be removed where access is readily available or capped off and abandoned in place as referenced on the drawings. Abandoned piping shall be identified on record drawings and tagged as abandoned.

1.3 Related Requirements

.1 This section of the Specification forms part of the Contract Documents and shall be read, interpreted, and coordinated with all other parts.

.2 Section 21 05 01 – Common Work Results for Mechanical

.3 Section 22 05 76 – Facility Drainage Piping Cleanouts

1.4 References

.1 The latest revisions of the following standards shall apply unless noted otherwise.

.2 Applicable Building Code - Refer to Section 21 05 01.

.3 ASTM B32: Standard Specification for Solder Metal.

.4 ASTM B306: Copper DWV tube drainage type, drawn temper.

.5 ASME B16.23 or ASME B16.29: Copper drainage fittings cast copper or wrought copper.

.6 ASTM F 628: Acrylonitrile-butadiene-styrene (ABS) drainage, waste, and vent pipe – cellular core.

.7 ASTM C564: Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings

.8 CAN/CSA-B70: Cast Iron Soil Pipe, Fittings, and Means of Joining.

.9 CAN/CSA-B602: Mechanical Couplings for Cast Iron Drain, Waste, Vent Pipe, and Sewer Pipe.

.10 CAN/CSA B181.1: Acrylonitrile-butadiene-styrene (ABS) drain, waste, and vent pipe and pipe fittings

.11 CAN/CSA B181.2: PVC solid wall DWV pipe, schedule 40, drain, waste, and vent piping and pipe fittings.

.12 CAN/ULC S102.2 Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies

1.5 Submittals

.1 Comply with Division 01 – Submittal Procedures and Closeout Procedures, Section 21 05 01 Common Work Results for Mechanical – Submittals and in addition the following:

.2 Shop drawings:

.1 Floor Drains

.2 Backwater Valves

1.6 Pipe, Fittings and Couplings

.1 Provide for all pipe, fittings, couplings, nipples, drains and all accessory pipe work for a complete installation within the base tender price.

.2 No extra cost will be considered based on failure of the contractor to allow for pipe, fittings and pipe work as required during construction to provide offsets to avoid structural components, and to coordinate with other piping services, ductwork, cable trays, conduits or other obstacles whether indicated on the drawings or not.

1.7 Seismic Protection

.1 Comply with Section 23 05 48 – Vibration and Seismic Control for Mechanical.

1.8 Substantial & Total Performance

.1 Comply with Section 21 05 01 Common Work Results for Mechanical – Substantial and Total Performance.

2. PRODUCTS

2.1 Pipe Hangers and Supports

.1 Comply with Section 23 05 29 – Hangers and Supports for Mechanical Piping and Equipment.

2.2 Cleanouts

.1 Comply with Section 22 05 76 – Facility Drainage Piping Cleanouts

2.3 Above Ground Pipe and Fittings

.1 Cast Iron drain, waste and vent pipe and fittings:

.1 3 NPS to 15 NPS

.2 Class 4000 cast iron mechanical joint pipe complying to CAN/CSA-B70.

.3 Stainless steel couplings with neoprene or butyl rubber compression gaskets complying to CAN/CSA-B602.

.2 Acrylonitrile Butadiene Styrene (ABS-DWV) (combustible building applications only)

.1 3 NPS to 6 NPS

.2 ABS solid core DWV pipe, schedule 40, with solvent weld socket joints conforming to CAN/CSA B181.1.

.3 ABS fittings shall be solvent welded socket type using a two-step solvent cement conforming to ASTM D2235.

.3 Acrylonitrile Butadiene Styrene (ABS-DWV) (combustible building applications only)

.1 3 NPS to 6 NPS

.2 ABS cellular core DWV pipe, schedule 40, with solvent weld socket joints conforming to ASTM F 628.

.3 ABS fittings shall be solvent welded socket type using a two-step solvent cement conforming to ASTM D2235.

.4 Polyvinyl Chloride (PVC 15) (non-combustible building applications)

.1 1½ NPS to 24 NPS

.2 Polyvinyl chloride (PVC), schedule 40 solid wall pipe, and fittings are permitted where the waste temperature is below 60°C.

.3 Pipe and fittings shall have a flame spread rating of not greater than 25 as per CAN/ULC S102.2

.4 PVC solid wall DWV pipe, schedule 40, with solvent weld socket joints conforming to CAN/CSA B181.2.

.5 PVC fittings shall be solvent welded socket type using a two-step solvent cement conforming to ASTM D2564.

.5 Copper Tube, (DWV)

.1 Copper DWV tube sanitary waste, drain and vent pipe may be used for piping above ground, except for the fixture drain or the portion of the vent pipe below the flood level rim of manually flushing and waterless urinals.

.2 The copper DWV tube shall be drainage type, drawn temper conforming to ASTM B306.

.3 The copper drainage fittings shall be cast copper or wrought copper conforming to ASME B16.23 or ASME B16.29.

.4 The joints shall be lead free solder, using a water flushable flux, and conforming to ASTM B32.

2.4 Below Ground Piping and Fittings

.1 Cast iron drain, waste and vent pipe and fittings:

.1 3 NPS to 15 NPS

.2 Class 4000 cast iron mechanical joint pipe complying to CAN/CSA-B70.

.3 Stainless steel couplings with neoprene or butyl rubber compression gaskets complying to CAN/CSA-B602.

.2 Acrylonitrile Butadiene Styrene (ABS-DWV)

.1 3 NPS to 6 NPS

.2 ABS solid core DWV pipe, schedule 40, with solvent weld socket joints conforming to CAN/CSA B181.1.

.3 ABS fittings shall be solvent welded socket type using solvent cement conforming to ASTM D2235.

.3 Polyvinyl Chloride (PVC-DWV)

.1 3 NPS to 16 NPS

.2 Polyvinyl chloride (PVC) pipe, schedule 40 solid wall pipe and fittings are permitted where the waste temperature is below 60°C.

.3 PVC solid wall DWV pipe, schedule 40, with solvent weld socket joints conforming to CAN/CSA B181.2.

.4 PVC fittings shall be solvent welded socket type using solvent cement conforming to ASTM D2564.

2.5 Backwater Valves

.1 Horizontal, Cast-Iron Backwater Valves

.1 Size: Same as connected piping.

.2 Body: Cast iron, cast iron cover with bolted access check valve.

.3 Check Valve: Removable, bronze and PVC, swing check, factory assembled or field modified to hang open for airflow unless subject to backflow condition.

.4 For underground installations, provide a full-size, cast-iron, soil-pipe extension to field-installed cleanout at floor. Replaces backwater valve cover.

.2 Drain-Outlet Backwater Valves.

.1 Size: Same as floor drain outlet.

.2 Body: Cast iron or bronze made for vertical installation in bottom outlet of floor drain.

.3 Check Valve: Removable ball float.

.4 Inlet: threaded, Outlet: threaded or spigot.

.3 Horizontal, Plastic Backwater Valves

.1 Size: Same as connected piping.

.2 Body: ABS or PVC.

.3 Cover: Same material as body with threaded access to check valve.

.4 Check Valve: Removable swing check.

.5 End Connections: Socket type.

2.6 Safes, Flashing and Vent Terminals

.1 Metal Flashing: 0.45 mm galvanized steel.

.2 Metal Counter flashing: 0.7 mm galvanized steel.

.3 Thicknesses of flashing fabricated on-site for vent pipes shall conform to the requirements of the applicable plumbing code/building code.

.4 Prefabricated flashing for vent pipes shall conform to CSA B272 – Prefabricated Self-Sealing Roof Vent Flashing.

.5 Lead Flashing:

.1 Waterproofing: 25 kg/m^2 sheet lead

.2 Soundproofing: 5 kg/m^2 sheet lead.

.6 Flexible Flashing: 1.2 mm thick sheet butyl; compatible with roofing.

.7 Floor Drain and Floor Sink Flashing: 1 mm thick chlorinated polyethylene (CPE). 25 kg/m^2 sheet lead flashings.

.8 Caps: Steel, 0.7 mm minimum; 1.6 mm at fire resistant elements.

3. EXECUTION

3.1 General

.1 Comply with manufacturer's installation instructions and the following:

.2 Route piping in orderly manner, maintain gradient, conserve building space and group piping whenever practical at common elevations.

.3 Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

.4 Class 4000 mechanical joint cast iron soil pipe, fittings and mechanical joint couplings shall be of one manufacturer.

.5 Copper to cast iron joints shall be male brass adaptors to tapped fittings.

.6 Nipples shall be cast iron or heavy brass.

.7 Support horizontal pipe runs and brace at intervals and points as recommended by the manufacturer and the local authority having jurisdiction.

.8 Support vertical pipe stacks and assemblies and brace as recommended by the manufacturer and the local authority having jurisdiction.

.9 Visually inspect materials for defects prior to installation.

.10 Reject defective material and remove from site.

.11 Surfaces must be clean and free of foreign matter at points of joining

.12 Prepare pipe, fittings, supports, and accessories not prefinished, ready for finish painting.

.13 Install bell and spigot pipe with bell end upstream.

.14 All floor mounted fixtures and floor flanges shall be secured on a firm base and fastened to the floor or flange of the fixture.

.15 Joints in a floor flange or between a fixture and the drainage system shall be provided with a resilient watertight and gas tight seal.

.16 Every screw, bolt, nut and washer used to connect a water closet to a floor flange and to anchor the floor flange to the floor or anchor the water closet to the floor shall be made of corrosion resistant materials.

.17 Where a vent passing through a roof may be subject to frost closure, it shall be protected from frost closure by increasing its diameter by one pipe size (but not less than 75 mm immediately prior to penetrating the roof or by other acceptable frost closure protection methods.

.18 Except for a wet vent, every vent pipe shall extend above the flood level rim of every fixture that it serves before running horizontal.

3.2 Pipe Hangers and Supports

.1 Comply with Section 23 05 29 – Hangers and Supports for Mechanical Piping and Equipment.

3.3 Cleanouts

.1 Comply with Section 22 05 76 – Facility Drainage Piping Cleanouts

3.4 Above and Below Ground Piping and Fittings

.1 Cast Iron Pipe and Fittings:

.1 Connect with mechanical joint couplings.

.2 Be aware of manufacturers torque requirements for varying coupling types and torque couplings accordingly.

.2 ABS / PVC Pipe and Fittings:

.1 Solvent cement joints shall be made in a two-step process with primer conforming to ASTM F 656 and solvent cement conforming to ASTM D 2564. The system shall be protected from chemical agents, fire-stopping materials, thread sealant, plasticized-vinyl products, or other aggressive chemical agents not compatible with ABS or PVC compounds.

.2 Do not install piping with glued joints at temperatures below those recommended by the solvent manufacture.

.3 Below Ground Pipe Support:

.1 Pipe Bedding:

.1 All buried piping inside the building below floors and slabs except for footing drains shall be supported on a bed of well compacted sand (95% Modified Proctor Density).

.2 Bedding shall extend from 150 mm below pipe and shall support the pipe barrel not the joints and/or couplings.

.3 Before backfilling, the complete line shall be tested and inspected and approved by the Authority Having Jurisdiction.

3.5 Back Water Valve

.1 Back water valves shall be installed in locations as noted on the drawings.

.2 Provide support for the backwater valve where suspended in a pit.

.3 Pits for backwater valves shall be sized to accommodate backwater valve dimensions and all fittings.

3.6 Safes, Flashing and Vent Terminals

.1 Provide flexible flashing and metal counter flashing where piping penetrates weather or waterproofed walls and floors.

.2 CPE lining or lead material may be used under built-up floor sinks and showers; and at floor drains and cleanouts. CPE shall be solvent welded to manufacturer's installation instructions. Lead shall not be used on roofs where the roofing material is applied by a torch-on method.

.3 Flash floor drains in floors with topping over finished areas with lead or CPE membrane, a minimum of 300mm clear on sides with minimum 900mm x 900mm sheet size. Fasten flashing to drain clamp device.

.4 Seal floor, shower, mop sink, etc. drains watertight to adjacent materials.

.5 Supply and install 25 kg/m² lead safes under built-up showers and mop sinks on any floor, which is not slab-on-grade. The safes shall extend across the floors and up walls and curb to a minimum height of 150 mm and shall be turned into the floor drain flange, unless specifically noted otherwise. Seams shall be welded (burned), not soldered. Any metal shall be commercially pure lead only. Treat both sides of the safe with two coats of asphalt.

.6 Provide acoustical lead flashing around pipes penetrating equipment rooms, installed in accordance with manufacturer's instructions for sound control.

.7 Adjust storm collars tight to pipe with bolts; caulk around top edge. Use storm collars above roof jacks. Screw vertical flange section to face of curb.

.8 Terminate all vent terminals a minimum of 25 mm above the water level at which roof drainage overflows through roof overflow scuppers or drains.

.9 Distances of vent terminals from all building openings, fresh air intakes and property lines shall be in compliance with the applicable code and the Authority Having Jurisdiction requirements.

.10 Vent flashing minimum 450 mm x 450 mm base dimension shall terminate flush with the top of 300 mm high vent pipe and the gap between the flashing and pipe shall be closed with a 25 kg/m² separate lead cap 75 mm high. The main flashing shall not be turned over the pipe.

.11 In areas subject to vandalism, terminate vents with 180° return bends.

3.7 Excavation & Backfilling

.1 Provide excavation, trenching and backfill required for the installation of the mechanical work. Do not undertake any cutting, boring or excavating in or about the building, which may cause interference with the progress of the work or weaken the structure in any way, without the prior approval of the Departmental Representative.

.2 Trenching for buried services shall be deep enough to accommodate the required pipe grade, bedding material depth, pipe outside diameter and backfilling of trench with approved backfill material to 300mm above top of pipe. Trench width from outside walls of pipe to trench walls shall be as narrow as proper joining and backfilling will permit.

.3 Backfilling in all trenches shall be with clean river sand (pea gravel where approved), carefully placed and tamped in uniform layers for the full width of the trench to a height of 300mm over the top of the pipe. All backfill material shall be free of stones, boulders, cinders and frozen material. Remainder of all trenches shall be filled by the Contractor.

.4 Where sanitary sewer pipes pass under a grade beam or footing the trench around the piping up to and in contact with the footing shall be provided with a 450 kg concrete grouting so as to seal the outside trenching from normal storm runoff and backflow of rain water through the trenching and into the crawl space and/or under the floor slab.

.5 Where sanitary sewer, pipes pass through exterior walls below grade, the Contractor shall install corbels on the exterior walls and run bridging from corbel to undisturbed soil for the support of the pipes. 25mm thick waterproof mastic shall be applied around the pipes which pass through the wall.

.6 Be responsible for repairing and making good, to match original condition, all existing concrete walls, pavement, walkways etc., where these have been damaged by this Division

3.8 Testing and Adjustment

.1 General:

.1 In accordance with Section 23 08 00 Commissioning of Mechanical Systems and the following:

.2 Test for leaks and defects all new plumbing piping systems and parts of existing systems, which have been altered, extended or repaired. Submit to the Departmental Representative a copy of a Pipe Pressure Test Log for each section of piping tested.

.3 Leave uncovered and unconcealed all new, altered, extended, or replaced piping until it has been tested and reviewed. Expose all such work for testing that has been covered or concealed before it has been tested and approved.

.4 Repair all leaks and defects using new materials and retest all plumbing systems until satisfactory results are obtained.

.2 Plumbing Piping Pressure Testing

.1 Tests on the sanitary waste drainage systems shall consist of a hydraulic pressure testing of 3000 mm for 8 hours.

.2 An air test in accordance with the Plumbing Code may be used during freezing conditions.

.3 Access doors:

.1 Verify size and location relative to items to be accessed.

.4 Cleanouts:

.1 Verify covers are gas-tight, secure, yet readily removable.

END OF SECTION

1. GENERAL

1.1 Section Scope

.1 The supply and installation of plumbing fixtures and trim.

.2 Fixtures and trim installed but not supplied under this section.

1.2 Related Requirements

.1 This section of the Specification forms part of the Contract Documents and is to be read, interpreted, and coordinated with all other parts.

.2 Section 21 05 01 – Common Work Results for Mechanical.

1.3 References

.1 The latest revisions of the following standards shall apply unless noted otherwise:

.2 Canadian Standards Association (CSA International).

.1 CAN/CSA-B45 Series, Plumbing Fixtures.

.2 CAN/CSA-B125, Plumbing Fittings.

1.4 General Requirements

.1 Provide new fixtures, CSA approved, free from flaws and blemishes with finished surfaces clear, smooth, and bright.

.2 Provide CSA approved plumbing fittings. Visible parts of fixture brass and accessories shall be heavily chrome plated.

.3 Fixtures shall be the product of one manufacturer. Fittings of the same type shall be the product of one manufacturer.

.4 Protect fixtures against use and damage during construction.

1.5 Submittals

.1 Comply with Division 01 – Submittal Procedures and Closeout Procedures, Section 21 05 01 Common Work Results for Mechanical – Submittals and in addition the following:

.1 All fixtures and fittings.

2. PRODUCTS

2.1 Manufactured Units

.1 Fixtures: manufacture in accordance with CAN/CSA-B45 series.

.2 Trim, fittings: manufacture in accordance with CAN/CSA-B125.

.3 Vitreous china fixtures shall be white unless otherwise noted.

.4 Stainless steel fixtures shall be satin and/or mirror finish or combination thereof.

2.2 General

.1 Plumbing fixture quantity and locations indicated on the architectural drawings shall govern.

2.3 Lavatory – Counter Mount

.1 Basin, faucet, ball valve angle stops, flexible riser supplies and drain for a complete installation. Refer to drawing schedule.

2.4 Kitchen Sink – Double Compartment

.1 Basin, faucet, ball valve angle stops, flexible riser supplies and drain for a complete installation. Refer to drawing schedule.

2.5 Water Closet – Flush Tank

.1 Water closet, seat, ball valve angle stop with escutcheon, flexible riser supply, floor flange made of brass or cast-iron with all brass bolts and rubber gasket for a complete installation. Refer to drawing schedule.

2.6 Clothes Washer

.1 Box: Water tight, white finish, NPS 2 drain opening, supports a single lever valve with arrestors, integral support frame.

.2 Valve: Satin chrome finish brass body, manual single lever washing machine shut off valve, (turns off both hot and cold water supplies) copper straight dual adapters to suit pipe material.

.3 Hammer Arrestors: Mounted to valve, bellows type with welded stainless steel nesting bellows or piston style and stainless steel casing. Air chambers are unacceptable.

2.7 Shower

.1 Prefabricated shower unit, pressure independent shower valve with integral check stops, shower head and shower drain for a complete installation. Refer to drawing schedule.

3. EXECUTION

3.1 Installation General

.1 Sinks shall not be used to clean paint brushes, trowels, etc. Do not dispose construction waste down any plumbing fixtures.

.2 Provide chrome flexible risers or supplies to fixtures, reducers, and escutcheons.

.3 Provide sealant between finished walls and horizontal surfaces of water closets and lavatories etc. Sealant shall be a continuous smooth with a beveled watershed, sealant shall be mildew/algae resistant.

.4 Provide necessary hangers, supports, brackets, reinforcements, steel back-up plates and floor flanges to set fixtures level and square. Mount fixtures so 91 Kg mass will not loosen or distort mounting.

.5 Provide water hammer arrestors or shock absorbers on fixtures with quick closing valves or solenoid valves.

.6 Review millwork shop drawings. Confirm location and size of fixtures and openings before rough-in and installation.

.7 All bathtubs and shower bases shall be provided with slip resistant surface regardless of units specified.

.8 All waste arms from traps shall be mechanical joint to risers not soldered.

3.2 Installation of Water Closets:

.1 All water closets shall be complete with flange, wax or rubber seal, bolt caps, etc.

.2 Water closets shall be connected to waste utilizing brass, cast-iron, or ABS floor flanges with lead stub or mechanical joint connections and wax seals.

.3 Solidly attach floor mounted water closets to floor with lag screws. Lead flashing shall not hold closet in place.

.4 Polished chrome flexible pipe supplied with metal compression rings are acceptable for tank type water closets. Supply shall incorporate NPS 1/2 x 3/8 compression outlet angle stop complete with 300mm long flexible riser to fixture.

.5 Provide NPS 3 drain pipe connections and branch drains from all water closets sloped at 2% unless otherwise noted on the layout plans. Use staggered wye connections at toilet branch drain connections; avoid flat double wye connections.

3.3 Installation of Lavatories and Sinks

.1 Polished chrome flexible pipe supplied with metal compression rings are acceptable for lavatories and sinks. Supply shall incorporate NPS ½ x 3/8 compression outlet angle stop complete with a minimum 375mm long flexible riser to fixture.

.2 Fixture punchings for faucets or other trim shall match holes necessary for specified trim.

.3 Double waste fittings for lavatories and sinks shall be double sanitary tee.

.4 Provide gaskets and/or sealing washers to prevent entry of water into fixture trim, faucet holes, or punchings in millwork.

.5 Provide fixture and templates to applicable trades for holes and cut outs required in millwork.

.6 Plastic control handles and spouts are unacceptable.

.7 Lavatory and sink P-traps shall be complete with either a cleanout or slip joint connection.

3.4 Adjusting

.1 Adjustments: Adjust pressure to fixtures to ensure no splashing at maximum pressures.

.2 Checks: Aerators: operation, cleanliness. Vacuum breakers, backflow preventers: operation under all conditions.

.3 Thermostatic controls: Verify temperature settings, operation of control, limit, and safety controls.

.4 Adjust stops or valves for intended water flow rate to fixtures without splashing, noise, or overflow.

.5 Adjust and commission dual flush toilets for lever and flush mechanism play as well as tank level fill to manufacturer’s specific settings and installation instructions.

3.5 Schedules

.1 Fixture Rough-Ins:

Fixture	Water Supply	Sanitary Drain
Water Closet - Flush Tank	NPS 1/2	NPS 3
Lavatory	NPS 1/2	NPS 1-1/2

Fixture	Water Supply	Sanitary Drain
Sink	NPS 1/2	NPS 1-1/2
Bath / Shower	NPS 1/2	NPS 1-1/2
Soaker Tub	NPS 3/4	NPS 1-1/2
Body Spray	NPS 1	NPS 1-1/2

END OF SECTION

HANGERS AND SUPPORTS FOR MECHANICAL PIPING AND EQUIPMENT

1. GENERAL

1.1 Section Scope

.1 Materials and installation for hangers and supports for mechanical and plumbing piping, ducting and equipment.

1.2 Related Requirements

.1 This section of the Specification forms part of the Contract Documents and is to be read, interpreted and coordinated with all other parts.

.2 Section 21 05 01 – Common Work Results for Mechanical

.3 Section 23 05 48 – Vibration and Seismic Control for Mechanical.

1.3 References

.1 The latest revisions of the following standards shall apply unless noted otherwise.

.2 American National Standards Institute/American Society of Mechanical Engineers (ANSI/ASME)

.1 ANSI/ASME B31.1 – Power Piping.

.3 ASTM International

.1 ASTM A125 – Standard Specification for Steel Springs, Helical, Heat-Treated.

.2 ASTM A307 – Standard Specification for Carbon Steel Bolts, Studs and Threaded Rod, 60,000 PSI Tensile Strength.

.3 ASTM A563 – Standard Specification for Carbon and Alloy Steel Nuts.

.4 Manufacturer's Standardization Society of the Valves and Fittings Industry (MSS)

.1 MSS SP58 – Pipe Hangers and Supports - Materials, Design and Manufacture.

.5 Underwriter's Laboratories of Canada (ULC)

1.4 Submittals

.1 Comply with Division 01 – Submittal Procedures and Closeout Procedures, Section 21 05 01 Common Work Results for Mechanical – Submittals and additionally the following:

.1 Submit shop drawings for:

.1 Bases, hangers and supports.

.2 Connections to equipment and structure.

.3 Structural assemblies.

.2 Certificates:

.1 Submit certificates from the manufacturer certifying that materials comply with specified performance characteristics and physical properties of the listed Related Standards.

.3 Manufacturers' Instructions:

.1 Provide manufacturer's installation instructions.

1.5 General Requirements

.1 Plumbing piping: to the more stringent requirements of the BC Plumbing Code and the National Plumbing Code of Canada.

.2 Construct pipe hangers and supports to manufacturer's recommendations utilizing manufacturer's regular production components, parts and assemblies.

.3 Base maximum load ratings on allowable stresses prescribed by ASME B31.1 or MSS SP58.

.4 Ensure that supports do not transmit excessive quantities of heat to building structure.

.5 Design hangers and supports to support systems under conditions of operation, allow free expansion and contraction, prevent excessive stresses from being introduced into pipework or connected equipment.

.6 Provide for vertical adjustments after erection and during commissioning. Amount of adjustment in accordance with MSS SP58.

.7 Provide hangers and supports to secure equipment in place, prevent vibration, protect against damage from earthquake, maintain grade, provide for expansion and contraction and accommodate insulation.

.8 Support from (top of) structural members. Where structural bearings do not exist or inserts are not in suitable locations, suspend hangers from steel channels or angles. Provide supplementary structural members, as necessary.

2. PRODUCTS

2.1 General

.1 Fabricate hangers and supports in accordance with ANSI B31.1 and MSS SP58.

.2 Use components for intended design purpose only. Do not use for rigging or erection purposes.

.3 Power actuated fasteners and “drop-in” anchors shall not be used for tension load applications such as pipe and duct hangers.

2.2 Riser Clamps

.1 Steel or cast iron pipe: galvanized carbon steel to MSS SP58, type 42, UL listed, FM approved.

.2 Copper pipe: carbon steel copper plated to MSS SP58, type 42.

.3 Bolts: to ASTM A307.

.4 Nuts: to ASTM A563.

2.3 PEX Pipe Support

.1 NPS 3 and under

.1 Non-combustible, self-gripping, galvanized-steel channel for crosslinked polyethylene (PEX-a) pipe. To provide continuous, uninterrupted support of PEX-a pipe.

.2 PEX-a pipe support shall be minimum 2700 long complete with stainless-steel strapping.

.2 Use PEX-a Pipe Support in conjunction with un-insulated PEX-a pipe in ASTM E84 plenum applications.

.3 The PEX-a pipe with pipe support can be insulated with typical CTS (copper tube size) pipe insulation.

2.4 Insulation Protection Shields

.1 Insulated cold piping:

.1 64 kg/m^3 density insulation plus insulation protection shield, galvanized sheet carbon steel. Length designed for maximum 3 m span.

.2 Non-metallic support coupling, sized to suit standard and millimeter pipe O.D. UL listed, meeting 25/50 flame and smoke spread ratings. Supplied with hanger and/or strut mount as a complete support assembly.

.2 Insulated hot piping:

.1 Curved plate 300 mm long, with edges turned up, welded-in centre plate for pipe sizes NPS 300 mm and over.

.2 For piping to 60°C Non-metallic support coupling, sized to suit standard and millimeter pipe O.D. UL listed, meeting 25/50 flame and smoke spread ratings. Supplied with hanger and/or strut mount as a complete support assembly.

2.5 Equipment Supports

.1 Fabricate equipment supports not provided by equipment manufacturer from structural grade steel meeting requirements of Division 5. Submit calculations with shop drawings.

2.6 Equipment Anchor Bolts and Templates

.1 Provide templates to ensure accurate location of anchor bolts.

2.7 Other Equipment Supports

.1 Fabricate equipment supports from structural grade steel meeting requirements of Division 5.

.2 Submit structural calculations with shop drawings.

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 and recommendations.

.2 Vibration Control Devices:

.1 Install on piping systems as indicated.

.3 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.

.4 Clevis plates:

.1 Attach to concrete with 4 minimum concrete inserts, one at each corner.

.5 Provide supplementary structural steelwork where structural bearings do not exist or where concrete inserts are not in correct locations.

3.3 Hanger Spacing

.1 Within 300 mm of each elbow.

Maximum Pipe Size NPS	Maximum Spacing Steel m	Maximum Spacing Copper m	Minimum Rod Dia mm
up to 1/2	1.8	1.5	9
3/4, 1	2.4	1.8	9

.2 Install PEX-a pipe support vertically or horizontally for plenum and non-plenum applications or support PEX pipe at 900 mm intervals with manufactured hanger fittings regardless of size. PEX installed with PEX-a pipe support shall follow the manufacturers pipe support recommendations for hanger spacing

.3 For other plastic piping, provide supports at intervals recommended by manufacturer.

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.

.4 Install hangers to provide minimum 13 mm space between finished covering and adjacent work.

.5 Support vertical piping at every other floor.

.6 Where several pipes can be installed in parallel and at the same elevation, provide multiple or trapeze hangers.

.7 Support riser piping independently of connected horizontal piping.

.8 Install plastic inserts between steel studs and piping.

.9 Provide insulation protection saddles on all insulated piping.

3.5 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.

END OF SECTION

1. GENERAL

1.1 Section Scope

.1 The work in this section includes, but is not limited to the following:

.1 Vibration isolation for ductwork, and equipment.

.2 Equipment isolation bases.

.3 Seismic restraints for isolated equipment.

.4 Certification of seismic restraint designs and installation supervision.

1.2 Related Requirements

.1 This section of the Specification forms part of the Contract Documents and is to be read, interpreted, and coordinated with all other parts.

.2 Section 21 05 01 – Common Work Results for Mechanical.

.3 Section 23 33 00 - Duct Accessories.

1.3 References

.1 The latest revisions of the following standards shall apply unless noted otherwise.

.2 Applicable Building Code: Refer to Section 21 05 01 – Common Work Results for Mechanical.

.3 Sheet Metal and Air Conditioning Contractors National Association (SMACNA):

.1 SMACNA – Seismic Restraint Manual Guidelines for Mechanical Systems.

.4 American Society of Heating, Refrigeration, and Air Conditioning Engineers ASHRAE):

.1 ASHRAE HVAC Applications Handbook (Seismic Design Chapter 54).

.5 Federal Emergency Management Agency (FEMA):

.1 FEMA – Installing Seismic Restraints for Mechanical Equipment.

.6 Vibration Isolation and Seismic Control Manufacturers Association (VISCMA).

.1 VISCMA – Installing Seismic Restraints for Mechanical Equipment.

1.4 Submittals

.1 Comply with Division 01 – Submittal Procedures and Closeout Procedures, Section 21 05 01 Common Work Results for Mechanical – Submittals and additionally the following:

.1 Consultant Assurance of Professional Design and Commitment for Field Review by Supporting Registered Professional Schedule S-B and Assurance of Professional Field Review and Compliance by Supporting Registered Professional Schedule S-C for seismic engineering.

.2 Shop drawings: submit drawings for vibration control stamped and signed by a Professional Engineer.

.3 Shop drawings: submit drawings for seismic control stamped and signed by a Professional Engineer registered or licensed in Province of British Columbia.

.4 Provide separate shop drawings for each isolated system complete with performance and product data.

1.5 General Requirements

.1 All mechanical equipment, piping, and ductwork as noted on the equipment schedule or in the specification shall be mounted on vibration isolators to prevent the transmission of vibration and mechanically transmitted sound to the building structure. Vibration isolators shall be selected in accordance with the weight distribution so as to produce reasonably uniform deflections.

.2 Provide seismic restraints for all required equipment, piping, and ductwork.

.3 Responsibilities:

.1 The Contractor shall retain the services of a qualified professional seismic engineer (Seismic Engineer) registered in the Province of British Columbia. The Seismic Engineer shall design and review the installation of all seismic restraints as well as mechanical equipment and mechanical system supports. The restraints and supports shall be specifically designed to fasten to the structure indicated in the contract documents and installed in the field. The complete design for these systems shall comply with all applicable building code requirements.

.2 Seismic Engineer shall provide and submit to the Departmental Representative Assurance of Professional Design and Commitment for Field Review by Supporting Registered Professional Schedule S-B and Assurance of Professional Field Review and Compliance by Supporting Registered Professional Schedule S-C for seismic engineering.

.3 Manufacturer of vibration isolation and seismic control equipment shall have the following responsibilities:

.1 Determine vibration isolation and seismic restraint sizes and locations.

.2 Provide vibration isolation and seismic restraints as scheduled or specified.

.3 Provide calculations and materials if required for restraint of non-isolated equipment.

.4 Provide installation instructions, drawings and trained field supervision to insure proper installation and performance.

.4 All isolators and isolation materials shall be of the same manufacturer and shall be certified by the manufacturer.

.5 It is the intent of the seismic portion of this specification to keep all mechanical and electrical building system components in place during a seismic event.

.6 All such systems must be installed in strict accordance with seismic codes, component manufacturer's, and building construction standards. Whenever a conflict occurs between the standards, the most stringent shall apply.

.7 Seismic restraints shall be designed in accordance with seismic force levels as indicated in the Building Code for the specific region of the project.

.8 All elastomeric components in isolation pads, mounts, and seismic snubbers shall be bridge bearing neoprene, meeting CSA Standard CAN3-S6 Section 11.10.

.9 Provide an acceptable means of corrosion protection for all equipment, attachments, and accessories supplied under this section, suitable for the conditions in which this equipment, etc. will be installed.

.10 Bolt all equipment to the structure. Do not bridge isolation elements.

.11 Use ductile materials in all vibration isolation equipment.

.12 Motor Drive Equipment:

.1 Provide vibration isolation on all motor driven fans regardless of power rating and all other motor driven equipment over 0.35 kW (as indicated on the motor nameplate), and on piping and ductwork specified herein.

.2 For fans less than 0.35 kW, provide isolation with neoprene grommets at the support points. Select isolators for a minimum static deflection of 3mm.

.13 Isolators:

.1 Provide neoprene isolators for deflections 6mm and under.

.2 Provide either neoprene or steel spring isolators for deflections between 6mm and 12mm.

.3 Provide steel spring isolators for deflections of 12mm and over.

.4 Provide adjustable limit stops for spring isolation mounts on equipment with operating weights substantially different from the installed weights.

.5 All spring isolators shall be “open spring” unless otherwise stated. Seismically rated housed spring isolators may be used in lieu provided that they meet this project's requirements for seismic restraint.

.6 Isolators and bases which are factory supplied with equipment shall meet the requirements of this section. Where internal isolation is provided, the isolation requirements specified in the minimum static deflection table apply to all separate vibration sources in the unit. Where internal vibration isolation is not provided, the unit frame shall be rigid enough such that the isolators can be attached directly without additional stiffening.

.7 Space isolators under equipment so that the minimum distance between adjacent corner isolators is at least equal to the height of the center of gravity of the equipment. Include height of center of gravity on shop drawings. Otherwise, provide suitable horizontal restraint isolators.

.8 Select isolators in accordance with equipment weight distribution to allow for an average deflection meeting or exceeding the specified deflection requirements and so that no isolator has a deflection less than 80% of the static deflection specified. A minimum of 4 isolators are required for each piece of equipment, unless specified otherwise. Number and colour code each isolator to show location. Mark code number and colour on shop drawings, on each isolator and on each base to ensure proper placement. Clearly tag all springs to show undeflected height and static deflection.

.9 Refer to the minimum static deflection table contained in this Section.

.14 Ducting:

.1 Install flexible duct connectors on all ductwork connected to isolated equipment.

.15 Piping Hangers:

.1 Provide resilient hangers on all piping, etc., rigidly connected to vibration isolated equipment. Provide the hangers for a distance of 3.0m for a 1 NPS pipe and 13.5m for a 10 NPS pipe. Isolate other pipe sizes for a proportionate distance (both interpolation and extrapolation may be required). Select the three closest hangers to the vibration source for the lesser of 25mm static deflection or the static deflection of the isolated equipment. Select the remaining isolators for the lesser of 25mm static deflection or one-half the static deflection of the isolated equipment.

.2 Where resilient hangers cannot be provided for piping rigidly connected to vibration isolated equipment (such as a rigid fire-stop falling within the required isolation distance), provide flexible connectors. One end of each flexible connector shall be installed directly to a flange of the isolated equipment (between the equipment and isolation valves) unless otherwise indicated on the drawings.

.16 Electrical Connections:

.1 Coordinate with the Division 26 to ensure all electrical connections to vibration isolated equipment is made with flexible conduit or other flexible means and does not restrict the maximum anticipated movement.

1.6 Regulatory Requirements

.1 Tested values must show that the seismic restraint hardware used in conjunction with the vibration isolation product is capable of withstanding the increased forces, as calculated for the specific project, using the formulae provided in the applicable building code.

.2 Supply isolators and seismic restraints meeting the structural requirements of the building code, including Section 4.1.8.18 with respect to seismic snubbers, or provide equivalent requirements where integral seismic restraint is provided in isolators / bolting.

.3 Include building code Section 6.2.1.6(2). Vibration isolator housings are considered a safety guard with respect to isolated equipment and any contained compressed springs. Include "Fail Safe" seismic restraint in all vibration isolation designed to hold mechanical equipment and springs in place.

2. PRODUCTS

2.1 General

.1 Isolation, anchors, bolts, restraints, etc., are to be designed to withstand without failure or yielding, the dynamic G load as specified in Code for the seismic zone in which building is located. Design loads are ultimate limit state loads (1.5 times working load) acting through the centre of gravity of the anchored or restrained equipment. "Fail Safe" designs are acceptable.

.2 Where impact forces may be significant, use ductile materials.

.3 Seismic restraining devices factory supplied with equipment are to meet requirements of this Section.

2.2 Open Spring Mounts

.1 Base mount free-standing assemblies, each complete with a stable colour coded steel spring welded in place, drilled mild steel mounting plate bonded to a ribbed rubber or neoprene acoustical pad, and an external 16 mm diameter level adjustment bolt.

2.3 Closed Spring Mounts

.1 Base mount free-standing enclosed assemblies, each complete with stable colour coded spring(s), 2 piece cast housing, non-binding rubber horizontal stabilizers, a ribbed rubber or neoprene acoustical pad bonded to base of the closed housing, and an external level adjustment bolt.

2.4 Totally Retained Spring Mounts

.1 Base mount free-standing enclosed and retained assemblies to limit both vertical and lateral movement of mounted equipment, each complete with stable colour coded spring(s), drilled welded steel housing and top plate, ribbed rubber or neoprene acoustical pad bonded to bottom of housing, vertical limit adjusting hardware, and a level adjustment bolt.

2.5 Type 1 - Neoprene Pad Isolators

.1 Neoprene or neoprene / steel / neoprene pad isolators.

.2 Minimum static deflection 2.5 mm or greater.

.3 Use hold down bolts selected for seismic loads. Isolate bolts from base of unit using neoprene washer/bushing.

.4 Size bolt and washer/bushing for minimum lateral clearance.

2.6 Type 7N – Neoprene Hangers

.1 Double deflection neoprene hangers shall consist of a rigid steel frame containing a neoprene element with an upper embedded steel washer and an integral bottom flange, which will protrude, and friction fit into the lower circular opening of the hanger frame. The lower hole in the hanger box shall be of a large enough diameter to permit the threaded hanger rod to swing through a minimum 30º arc from side to side before contacting the neoprene flange. Nominal static deflection under load shall be 5mm. No hanger shall be loaded to less than 50% of this deflection nor exceed the manufacturers maximum recommended loading.

2.7 Type 7S – Spring Isolation Hangers

.1 Spring isolation hangers shall consist of a rigid steel frame containing a steel spring (see Type 3) and shall be seated in a steel washer reinforced neoprene cup. This cup shall have a neoprene bushing projecting through the steel box. Spring diameters and hanger box lower hole diameters shall be large enough to permit the hanger rod to swing through a 30º arc from side to side before contacting the protruding neoprene bushing. Spring selection and submittal data similar to that for Type 3.

2.8 Type 7SN - Spring Hangers with Neoprene Elements

.1 Hangers shall consist of rigid steel frames containing minimum 32mm thick neoprene elements at the top and a steel spring seated in a steel washer reinforced neoprene cup on the bottom. The neoprene element and the cup shall have neoprene bushings projecting through the steel box.

.2 Provide a combination rubber and steel rebound washer as the seismic up stop for suspended piping, ductwork, and equipment. Rubber thickness shall be a minimum of 6mm.

.3 To maintain stability the boxes shall not be articulated as clevis hangers nor the neoprene element stacked on top of the spring.

.4 Spring diameters and hanger box lower hole diameters shall be large enough to permit the hanger rod to swing through a 30º arc from side to side before contacting the protruding neoprene bushing.

.5 Colour coded springs, rust resistant, painted box type hangers.

2.9 Type 8 - Neoprene Washer/Bushing

.1 A one piece molded bridge bearing neoprene washer/bushing. The bushing shall surround the anchor bolt and have a flat washer face to avoid metal to metal contact.

.2 Use washer/bushing only on light-weight equipment.

2.10 Type 10 – Acoustical Split Wall Seals

.1 Split wall seals shall consist of two bolted pipe halves with a minimum 18 mm thick neoprene sponge bonded to the liner faces. The seal shall be tightened around the pipe to eliminate clearance between the inner sponge face and the piping.

.2 Concrete may be packed around the seal to make it integral with the floor, wall, or ceiling if the seal is not already in place around the pipe prior to the construction of the building member. Seals shall project a minimum 25 mm past both sides of the wall.

.3 Where temperatures exceed 113°C 10# density fiberglass may be used in lieu of the sponge.

2.11 Type 13 - Flexible Piping Connections

.1 Flexible piping connectors are to be supplied with seismic restraint materials.

.2 Where flexible connections are not specified with piping in other Sections they are to be as specified herein.

.3 Expansion joints shall be peroxide cured EPDM throughout with Kevlar® tire cord reinforcement. Substitutions must have certifiable equal or superior characteristics. The raised face rubber flanges must encase solid steel rings to prevent pull out. Flexible cable wire is not acceptable.

.4 Sizes 19mm through 50mm may have one sphere, bolted threaded flange assemblies, and cable retention.

.5 Safety factors shall be a minimum of 3/1. All expansion joints must be factory tested to 150% of maximum pressure for 12 minutes before shipment.

.6 The piping gap shall be equal to the length of the expansion joint under pressure. Control rods passing through 13mm thick Neoprene washer bushings large enough to take the thrust at 0.7 kg/mm^2 of surface area may be used on unanchored piping where the manufacturer determines the condition exceeds the expansion joint rating without them.

.7 Submittals shall include two test reports by independent consultants showing minimum reductions of 20 DB in vibration acceleration and 10 DB in sound pressure levels at typical blade passage frequencies on this or a similar product by the same manufacturer.

.8 All expansion joints shall be installed on the equipment side of the shut off valves.

2.12 Type 14 - Flexible Duct Connectors

.1 Flexible duct connectors as specified in Section 23 33 00 Duct Accessories.

.2 Provide 75 mm flexible duct connectors and a 40 mm metal to metal gap.

2.13 Anchor Bolts

.1 Female wedge anchors are preferred in floor locations so isolators or equipment can be slid into place after the anchors are installed. Anchors shall be manufactured from full diameter wire, and shall have a safety shoulder to fully support the wedge ring under load. Female wedge anchors shall have an evaluation report number from the I.C.B.O Evaluation Service, Inc. verifying to its allowable loads.

2.14 Seismic Cable Restraints

.1 Galvanized steel aircraft cables sized to resist seismic loads with a minimum safety factor of two and arranged to provide all-directional restraint.

.2 Cables must be pre-stretched to achieve a certified minimum modulus of elasticity. Cable end connections shall be steel assemblies that swivel to final installation angle and utilize two clamping bolts to provide proper cable engagement.

.3 Cables must not be allowed to bend across sharp edges.

.4 Cable assemblies shall suit installation type:

.1 Ceiling and at the clevis bolt.

.2 Between the hanger rod nut and the clevis.

.3 Clamped to a beam.

3. EXECUTION

3.1 General

.1 All vibration isolators and seismic restraint systems must be installed in strict accordance with the manufacturers written instructions and all certified submittal data.

.2 Brace in-line equipment independently of ducts and pipes.

.3 Do not mix solid and cable bracing.

.4 All runs to have a minimum of two transverse and one longitudinal brace. A run is defined as any change in direction except offsets.

3.2 Seismic Restraint Installation

.1 The following Mechanical Components Restraint Guide is to be used as a general guide only to establish appropriate restraint methods, hardware, and attachments, however, due to differences in construction, size, weight, and configuration of different manufacturer's equipment and variety of ways and means that equipment and components can be installed, specific restraint methods are to be confirmed in the field. Seismic restraint materials and methods are to be reviewed and approved by Departmental Representative

3.3 Mechanical Component Restraint Guide

Item	Type Of Restraint	Minimum No. of Restraints	Notes
AHU's and A/C Units Suspended			
- Isolated	SCR	4	
- Non-Isolated	SCR	4	
Fans – Suspended			

Item	Type Of Restraint	Minimum No. of Restraints	Notes
- Isolated	SCR	4	
- Non-Isolated	SCR	4	
Grilles, Registers, Diffusers	SCR	4	Where not bolted to duct (i.e. in tee-bar ceilings)
Piping	SCR TSR	As required	As per Specification
Ductwork	SCR TSR	As required	As per Specification

LEGEND	
SCR	Slack cable restraint (bolted to structure)
TSR	Threaded support rod (bolted or clamped to structure)

3.4 Seismic Piping Restraints

.1 Seismically restrain all new piping as follows:

.1 Piping located in all utility and mechanical equipment rooms that is 1 ¼ NPS and larger.

.2 All other piping 2 ½ NPS and larger.

.2 Provide transverse piping restraints at 12m maximum spacing for all pipe sizes, except where lesser spacing is required to limit anchorage loads.

.3 Provide longitudinal restraints shall be at 24m maximum spacing for all pipe sizes, except where lesser spacing is required to limit anchorage loads.

.4 Hold down clamps must be used to attach pipe to all trapeze members before applying restraints in a manner similar to clevis supports.

3.5 Seismic Ductwork Restraints

.1 Seismically restrain all ductwork as follows:

.1 Restrain all ductwork and duct mounted equipment.

.2 Transverse restraints shall occur at 9m intervals or at both ends of the duct run if less than the specified interval. Transverse restraints shall be installed at each duct turn and at each end of a duct run.

.3 Longitudinal restraints shall occur at 18m intervals with at least one restraint per duct run.

.4 The ductwork must be reinforced at the restraint locations. Reinforcement shall consist of an additional angle on top of the ductwork that is attached to the support hanger rods. Ductwork is to be attached to both upper angle and lower trapeze.

.5 A group of ducts may be combined in a larger frame so that the combined weights and dimensions of the ducts are less than or equal to the maximum weight and dimensions of the duct for which bracing details are selected.

.6 Walls, including gypsum board non-bearing partitions, which have ducts running through them, may replace a typical transverse brace. Provide channel framing around ducts and solid blocking between the duct and frame.

3.6 Seismic Cable Restraints

.1 Cable restraints shall be installed slightly slack to avoid short circuiting the isolated suspended equipment, piping or conduit.

.2 Cable assemblies are installed taut on non-isolated systems.

.3 Where cable restraints are installed on support rods with spring isolators, the spring isolation hangers must be specification type.

3.7 Vibration Isolator Installation - General

.1 Vibration isolation products as outlined in section 2 above are to be applied based on 2 basic project specific situations. The requirements for each of these is outlined below:

.1 Acoustical classification AA - Office Towers, Multi Storey Condominiums

.2 Acoustical classification A - Commercial

.2 This project has an acoustical classification of AA. See Vibration Isolation Application Schedule for vibration isolation application requirements.

.3 Unless otherwise specified, vibration isolation products are to be product of one manufacturer.

.4 Ensure vibration isolation manufacturer coordinates material selections with equipment provided in order to ensure adherence to performance criteria. Allow for expansion and contraction when material is selected and installed.

.5 Use the lowest RPM scheduled for two-speed equipment in determining isolator deflection.

.6 Before bolting isolators to the structure, start equipment and balance the systems so that the isolators can be adjusted to the correct operating position before installing (seismically rated) anchors.

.7 Isolate piping larger than 25 mm dia. directly connected to motorized and/or vibration isolated equipment with 25 mm static deflection spring hangers at spacing intervals in accordance with following:

.1 For pipe less than or equal to 100 mm dia. – first 3 points of support;

.8 First point of isolated piping support is to have a static deflection of twice the deflection of the isolated equipment but maximum 50 mm.

.9 Flexible pipe connectors (Type 13 isolator) shall be provided and installed per the Vibration Isolation Application Schedule.

.10 Provide hot dipped galvanized housings and neoprene coated springs, or other acceptable weather protection, for all isolation equipment located outdoors or in areas of high moisture which may cause corrosion.

.11 Provide a minimum clearance of 50mm to other structures, piping, equipment, etc., for all equipment mounted on vibration isolators.

.12 Before bolting isolators to the structure, start equipment and balance the systems so that the isolators can be adjusted to the correct operating position before installing drilled inserts.

.13 After installation and adjustment of isolators, verify deflection under load to ensure loading is within specified range.

.14 Where isolated piping connected to noise generating equipment is routed from the utility or mechanical room through plumbing chases or other openings, position isolated piping to avoid contact with the structure, framing, gypsum wallboard and other elements which may radiate noise. Submit proposed details to meet this requirement. On all AA projects, Type 10 acoustical seals shall be provided on piping entering or leaving utility and mechanical rooms.

.15 Ensure that the installed seismic restraints do not adversely affect the proper functioning of any vibration isolation products required by this section.

.16 For control wiring connections to vibration isolated equipment ensure flexible metallic conduit with 90° bend is used for conduit 25 mm dia. and smaller. Connections are to be long enough so that conduit will remain intact if equipment moves 300 mm laterally from its installed position, and flexible enough to transmit less vibration to structure than is transmitted through vibration isolation. Coordinate these requirements with mechanical trades involved. If electrical power connections are not made in a similar manner as part of the electrical work, report this fact to Departmental Representative.

3.8 Type 7S & 7SN - Spring Hangers

.1 Locate isolation hangers as near to the overhead support structure as possible.

.2 Installation shall permit hanger box or rod to move through a 30 degrees arc without metal to metal contact.

.3 All discharge ductwork runs for a distance of 15m from the connected equipment shall be isolated from the building structure by means of spring hangers. Spring deflection shall be a minimum of 19mm.

3.9 Type 8 - Neoprene Washer/Bushing

.1 Isolate variable frequency drive controller using neoprene washer/bushing isolators or soft grommets such that structure borne noise transmission to occupied space is less than airborne noise transmission.

3.10 Type 13 - Flexible Piping Connectors

.1 Supply flexible piping connectors for connections (including plumbing) to seismically restrained equipment. Hand connectors to appropriate piping trade at site for installation.

3.11 Type 14 - Flexible Duct Connectors

.1 Install flexible duct connectors so that duct cross-section is not reduced by the deflection of the flexible connector.

3.12 Minimum Static Deflection Schedule

Equipment	Equipment Supported By:	
	Slab on Grade	Elevated Floor
Fans, Blowers & Packaged H & V Units:		
Under 0.5 HP	1mm	1mm
0.5 HP to 7.5 HP	25mm	25mm

NOTES:

.1 Table indicates required static deflection of isolators for all fans regardless of power rating and for all other motor driven equipment over 0.37kW.

.2 Advise Departmental Representative of equipment not contained in this table and obtain clarification as to the isolation performance requirements.

.3 Steel spring isolators shall be used for all deflections 12mm and over.

.4 Neoprene isolators shall be used for deflections 6mm and under.

3.13 Vibration Isolation Application Schedule

Equipment	AA	A
Piping		
Attached to Isolated Equipment	7SN - See 3.4.5	7SN - See 3.4.5
Through Mechanical Room Walls 1½"	10	-
Hot Water Risers - No Expansion Loops	11,12,13	-
Fans Hung		
>>1/2hp>>1200 rpm	7N & 14	8 & 14
Fractional	8 & 14	

Note:

.1 Table indicates type of isolation required and any other sections of note.

3.14 Field Quality Control

.1 Seismic Engineer:

.1 The Seismic Engineer shall perform all field services as required to fulfil the Building Code obligation for the provision of the Assurance of Professional Field Review and Compliance by Supporting Registered Professional Schedule S-C for seismic engineering.

.2 Submit concise field reports to the Departmental Representative within 3 days of each site review.

.3 Make adjustments and corrections in accordance with written report.

.2 Manufacturer's Field Services:

.1 Arrange with manufacturer's representative to review work of this Section and submit written reports to verify compliance with Contract Documents.

.2 Manufacturer's Field Services: consisting of product use recommendations and periodic site visits to review installation, scheduled as follows:

.1 Twice during the installation, at 25 % and 60 % completion stages.

.2 Upon completion of installation.

.3 Submit a concise manufacturer's report to the Departmental Representative within 3 days of manufacturer representative's review.

.4 Make adjustments and corrections in accordance with written report.

END OF SECTION

1. GENERAL

1.1 Section Scope

.1 Materials and installation for the identification of all mechanical piping, ducting, equipment, and controls.

1.2 Related Requirements

.1 This section of the Specification forms part of the Contract Documents and is to be read, interpreted, and coordinated with all other parts.

.2 Section 21 05 01 – Common Work Results for Mechanical.

1.3 References

.1 The latest revisions of the following standards shall apply unless noted otherwise.

.2 Canadian General Standards Board (CGSB):

.1 CAN/CGSB-1.60 – Interior Alkyd Gloss Enamel.

.2 CAN/CGSB-24.3 – Identification of Piping Systems.

1.4 Submittals

.1 Comply with Division 01 – Submittal Procedures and Closeout Procedures, Section 21 05 01 Common Work Results for Mechanical – Submittals and additionally the following:

.1 Submit data on all materials.

1.5 General Requirements

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

.2 Identify each system and system component according to the nomenclature used on the drawings and specifications. Identification to be consistent throughout the project.

.3 When identifying systems and components in existing buildings, the new items shall be numbered sequentially with existing systems. Where possible include the zone or building area serviced by each system.

.4 Submit list of system and component labels to be Departmental Representative for review prior to engraving.

2. PRODUCTS

2.1 Piping Systems Governed by Codes

.1 Any piping that is governed by CSA or any other applicable code as addressed in contract documents, is to comply with those applicable codes concerning identification.

2.2 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.

2.3 System Equipment Nameplates

.1 Each piece of equipment shall be identified with its equipment schedule identification, e.g. supply fan SF-1, cooling coil CC-1, pump P-1.

.1 Coordinate equipment with drawings and with Departmental Representative's requirements

.2 Colours:

.1 Hazardous: red letters, white background.

.2 Elsewhere: black letters, white background (except where required otherwise by applicable codes).

.3 Construction:

.1 3 mm thick laminated plastic or white anodized aluminum, matte finish, with square corners, letters accurately aligned and machine engraved into core.

.4 Sizes:

.1 Conform to following table:

Size No.	Size (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.

.5 Locations:

.1 Terminal cabinets, control panels: use size # 5.

.2 Equipment in Mechanical Rooms: use size # 9.

2.4 Piping Systems Identification

.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 by Workplace Hazardous Materials Information System (WHMIS) regulations.

.3 Letter Height:

.1 13 mm high - 1-1/4 NPS pipe & smaller.

.2 25 mm high - 1-1/2 NPS up to 2-1/2 NPS pipe.

.3 50 mm high - 3 NPS and larger pipe.

.4 Arrows showing direction of flow:

.1 Outside diameter of pipe or insulation less than 75mm: 100mm long x 50mm high.

.2 Outside diameter of pipe or insulation 75mm and greater: 150mm long x 50mm high.

.3 Use double-headed arrows where flow is reversible.

.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 20mm and smaller: waterproof and heat-resistant pressure sensitive plastic marker tags.

.2 Other pipes: pressure sensitive plastic-coated cloth or vinyl with protective overcoating, waterproof contact adhesive undercoating, suitable for ambient of 100% RH and continuous operating temperature of 150°C and intermittent temperature of 200°C.

.7 Colours and Legends:

.1 Where not listed, obtain direction from the Departmental Representative.

.2 Colours for legends, arrows: to following table:

Background Colour	Legend, Arrows
Yellow	BLACK
Green	WHITE
Red	WHITE
Blue	WHITE

.3 Background colour marking and legends for piping systems:

Contents	Background Colour Marking	Legend
Domestic Hot Water Supply	Green	DOM. HW SUPPLY, DHW
Domestic Cold Water Supply	Green	DOM. CW SUPPLY, DCW
Storm Water	Green	STORM
Sanitary	Green	SAN
Condensate Drain	Green	COND
Irrigation Water	Per CSA B128.1	

2.5 Valves, Controllers Identification

.1 Provide valve identification and secure with non-ferrous chain or "S" hooks suitable for the system temperature.

.2 Identification tags shall be of brass, aluminum, metalphoto, lamicoid or fiberglass, stamped or engraved with 12mm high identifier markings.

.3 Tag the following new valves as a minimum:

.1 Valves on main piping circuits.

.2 Valves on major branch lines.

.3 Valves on minor branch lines in horizontal or vertical service spaces and mechanical rooms.

.4 Drain valves and hose bibbs on systems containing glycol.

.5 Control valves.

.4 Do not tag the following valves:

.1 Valves on control valve stations.

.2 Plumbing fixture stops or hose bibbs.

.3 System drain valves.

.5 Provide a valve tag schedule. Include in the identification of each tagged item, valve type, service, function, normal position and location of tagged item.

.6 Provide a flow diagram for each system, reference applicable charts and schedules.

2.6 Ductwork Systems Identification

.1 50mm high stencilled letters and directional arrows 150mm long x 50mm high.

.2 Colours: back, or co-ordinated with base colour to ensure strong contrast.

2.7 Ductwork Access Identification

.1 Secure 50 mm high, self-adhesive stick on-letters, on duct access panels to identify their usage, according to the following:

.1 Cleaning and service access, colour black, tag “C.A”

.2 Controls including sensors, colour black, tag “C”

.3 Backdraft dampers, balance dampers and control dampers, colour black, tag “D”

2.8 Controls Components Identification

.1 Identify all systems, equipment, components, controls, sensors with system nameplates specified in this section. Include: sensors, transmitters, BMS controlled damper actuators, end-devices, distributed control panels (DCP)’s, application specific controllers (ASC)’s and field panels.

.2 Inscriptions to include function and (where appropriate) fail safe position.

2.9 Ceiling Access Identification

.1 Provide 6 mm self adhesive coloured dots to access doors in solid ceilings. Identify the location of equipment concealed above as follows:

.1 ***Yellow*** - Concealed equipment and cleaning access.

.2 ***Black*** - Control equipment, including dampers and sensors.

.3 ***Green*** –domestic cold water, domestic hot water isolation valves.

3. EXECUTION

3.1 General

.1 Provide identification only after painting has been completed.

.2 Perform work in accordance with CAN/CGSB-24.3 Identification of Piping Systems except as specified otherwise.

.3 Provide ULC and/or CSA registration plates as required by respective agency.

3.2 Nameplates

.1 Location shall be in conspicuous location to facilitate easy reading and identification from operating floor.

.2 Provide standoffs for nameplates on hot and/or insulated surfaces.

.3 Do not paint, insulate or cover nameplate data.

3.3 Location of Identification on Piping and Ductwork Systems

.1 Provide on long straight runs in open areas in equipment rooms: at not more than 17m 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 Provide adjacent to each change in direction.

.3 Provide at least once in each small room through which piping or ductwork passes.

.4 Provide on both sides of visual obstruction or where run is difficult to follow.

.5 Provide on both sides of separations such as walls, floors, partitions.

.6 Provide where system is installed in pipe chases, ceiling spaces, confined spaces, at entry and exit points, and at access openings.

.7 Provide at beginning and end points of each run and at each piece of equipment in run.

.8 Provide at point immediately upstream of major manually operated or automatically controlled dampers. Where this is not possible, place identification as close as possible, preferably on upstream side.

.9 Identification shall be easily and accurately readable from usual operating areas and from access points. Position the identification approximately at right angles to the 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.

3.4 Valves, Controllers Identification

.1 Provide identification on valves and operating controllers, except at plumbing fixtures or where in plain sight of equipment they serve.

.2 Install one copy of flow diagrams, valve schedules mounted in frame behind non-glare glass located in the main mechanical or utility room. Provide one copy in each operating and maintenance manual.

.3 Number valves in each system consecutively.

.1 Identification coding is to start with a utility description followed by a maximum of three numerals:

.2 Domestic Water DW-1, DW-2, DW-3…

.3 HVAC to be numbered H-1, H-2, H-3…

END OF SECTION

1. GENERAL

1.1 Section Scope

.1 Test to verify proper and safe operation, determine actual point of performance, evaluate qualitative and quantitative performance of equipment, systems and controls at design, average and low loads using actual or simulated loads

.2 Adjust and regulate equipment and systems to meet specified performance requirements and to achieve specified interaction with other related systems under normal and emergency loads and operating conditions.

.3 Balance systems and equipment to regulate flow rates to match load requirements over full operating ranges and document results.

1.2 Related Requirements

.1 This section of the Specification forms part of the Contract Documents and is to be read, interpreted, and coordinated with all other parts.

.2 Section 21 05 01 – Common Work Results for Mechanical.

.3 Section 23 08 00 – Commissioning of Mechanical Systems.

1.3 References

.1 The latest revisions of the following standards shall apply unless noted otherwise.

.2 Associated Air Balance Council (AABC)

.1 National Standards for Total System Balance, MN-1.

.3 National Environmental Balancing Bureau (NEBB)

.1 Procedural Standards for Testing, Adjusting, Balancing of Environmental Systems.

.4 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA)

.1 HVAC Systems – Testing, Adjusting, and Balancing.

.5 American Society of Heating, Refrigeration and Air-Conditioning Engineers (ASHRAE)

.1 ASHRAE 62.1 – Ventilation for Acceptable Indoor Air Quality.

.2 ASHRAE 62.2 – Ventilation for Acceptable Indoor Air Quality in Low Rise Residential Buildings.

1.4 General Requirements

.1 TAB is used throughout this Section to describe the process, methods, and requirements of testing, adjusting and balancing for HVAC.

.2 TAB means to test, adjust, and balance to perform in accordance with requirements of Contract Documents and to do other work as specified in this section.

1.5 Qualifications of TAB Personnel

.1 Employ qualified staff to test and balance the air systems.

.2 TAB shall be performed in accordance with one of the following standards:

.1 AABC – National Standards for Total System Balance, MN-1

.2 NEBB – Procedural Standards for Testing, Adjusting, Balancing of Environmental Systems

.3 SMACNA -HVAC Systems – Testing, Adjusting and Balancing

.3 Recommendations and suggested practices contained in the TAB Standard are mandatory.

.4 Use TAB Standard provisions, including checklists, and report forms to satisfy the Contract requirements.

.5 Where the instrument manufacturer's calibration recommendations are more stringent than those listed in TAB Standard, use manufacturer's recommendations.

.6 TAB Standard quality assurance provisions such as performance guarantees form part of this contract.

1.6 Exceptions

.1 TAB of systems and equipment regulated by codes, standards to satisfaction of authority having jurisdiction.

1.7 Submittals

.1 Comply with Section 21 05 01 – Common Work Results for Mechanical, Submittals, and the following:

.2 Preliminary TAB Report

.1 Submit for checking and approval of the Departmental Representative, prior to submission of formal TAB report, sample of rough TAB sheets. Include:

.1 Details of instruments used.

.2 Details of TAB procedures employed.

.3 Calculations procedures.

.4 List of air systems to be TAB

.5 Summaries.

.3 TAB Report

.1 Format in accordance with referenced standards.

.2 TAB report to show results in SI units and to include:

.1 Project record drawings.

.2 System schematics.

.3 Date of test, Name, and address of building and balancing technician's name.

.4 Range of outdoor air temperature during the balancing period.

.5 Main branch duct traverses. Maximum and minimum outdoor air quantities.

.6 Static pressure across each component in an air handling system at full flow.

.7 Static pressure across each fan.

.8 Fans: Tag, service and location, motor speed, fan specified and actual capacity. Fan motor size, starting time, amps, and voltage.

.9 Flow measuring devices: Flow rates.

.10 Provide fan performance curve for each new air handling system.

.3 Submit copies of TAB Report to the Departmental Representative for verification and approval.

1.8 Co-ordination

.1 Schedule time required for TAB (including repairs, re-testing) into project construction and completion schedule to ensure completion before acceptance of project.

.2 Do TAB of each system independently and subsequently, where interlocked with other systems, in unison with those systems.

1.9 Pre-TAB Review

.1 During construction, co-ordinate location and installation of TAB devices, equipment, accessories, measurement ports and fittings.

.2 Ensure devices are accessible and maintainable. Advise the installing Contractor of omissions or conflicts affecting the scope of this section.

.3 Review contract documents before project construction is started and confirm in writing to Departmental Representative the adequacy of provisions for TAB and that other aspects of design and installation are pertinent to the success of TAB.

.4 Review specified standards and report to Departmental Representative in writing describing any proposed procedures that vary from the standard.

1.10 Start-up

.1 Follow start-up procedures as recommended by equipment manufacturer unless specified otherwise.

.2 Follow special start-up procedures specified elsewhere in Divisions 21, 22, 23 and 25.

2. PRODUCTS

2.1 Instruments

.1 Prior to TAB, submit to the Departmental Representative a list of instruments used together with serial numbers.

.2 Calibrate in accordance with requirements of most stringent of referenced standards for applicable system.

.3 Calibration shall be within 6 months of TAB. Provide certificate of calibration to the Departmental Representative.

3. EXECUTION

3.1 Start of TAB

.1 Notify the Departmental Representative 7 days prior to start of TAB.

.2 Start TAB when building is essentially completed, including:

.1 Installation of ceilings, doors, windows, other construction affecting TAB.

.2 Application of weather-stripping, sealing, and caulking.

.3 Pressure, leakage, other tests specified elsewhere Division 23.

.4 Provisions for TAB installed and operational.

.3 Start-up, verification for proper, normal, and safe operation of mechanical and associated electrical and control systems affecting TAB including but not limited to:

.1 Proper thermal overload protection in place for electrical equipment.

.2 Air systems:

.1 Filters in place, clean.

.2 Duct systems clean.

.3 Ducts are airtight to within specified tolerances.

.4 Correct fan rotation.

.5 Volume control dampers installed and open.

.6 Coil fins combed, clean.

.7 Access doors, installed, closed.

.8 Outlets installed, volume control dampers open.

3.2 Tolerances

.1 Application Tolerances:

.1 Do TAB to following tolerances of design values:

.1 General HVAC systems: plus or minus 5%.

.2 Accuracy Tolerances:

.1 Measured values accurate to within plus or minus 2% of actual values.

.3 Site Tolerances:

.1 System leakage tolerances specified are stated as percentage of total flow rate handled by system. Pro-rate specified system leakage tolerances. Leakage for sections of duct systems: not to exceed total allowable leakage.

.2 Leakage tests on following systems not to exceed specified leakage rates.

.3 Small duct systems up to 250Pa: leakage 2%.

.4 Large low pressure duct systems up to 500Pa: leakage 2%.

.5 Evaluation of test results to use surface area of duct and pressure in duct as basic parameters.

3.3 Testing

.1 Test ducts and piping before installation of insulation or other forms of concealment. Do not externally insulate or conceal work until tested and approved.

.2 Test after seals have cured.

.3 Test when ambient temperature will not affect effectiveness of seals, and gaskets.

.4 Conduct tests in presence of the Departmental Representative.

.5 Bear costs including retesting and making good.

.6 Refer to Piping Sections for specific test requirements.

.7 Prior to tests, isolate all equipment or other parts which are not designed to withstand test pressures.

3.4 Air System Procedure

.1 Perform balancing, adjusting and testing with building doors and windows in their normal operation position.

.2 The following procedure shall be adopted for central systems:

.1 Ensure dampers or volume control devices are in fully open position.

.2 Balance central apparatus to ±10% air flow.

.3 Balance branches, mains to ±10% air flow.

.4 Recheck central apparatus.

.5 Balance all terminal air outlets to ±10%.

.6 Rebalance central apparatus to ±5%.

.7 Recheck all air outlets.

.8 Perform acoustical measurements.

.9 Perform building pressurization tests and measurements at minimum and maximum outdoor air damper positions of the main air unit(s).

.3 When balancing air outlets:

.1 Rough balance furthest outlets and then balance sequentially back to source.

.2 Fine balance furthest outlet back to source.

.4 Take static pressure readings and air supply temperature readings at 10 points on each air system.

.5 Make air quantity measurements in ducts by "Pitot Tube" traverse of entire cross sectional area. If readings are inconsistent across duct, relocate to two duct *diameters *widths and re-do traverse.

.6 Use volume control devices to regulate air quantities only to extent that adjustments do not create objectionable air motion or sound levels. Effect volume control only by duct internal devices such as dampers and splitters.

.7 Vary total system air quantities by adjustment of fan speeds. Vary branch air quantities by damper regulation.

.8 Where modulating dampers are provided, take measurements, and balance at extreme conditions.

.9 The final balanced condition of each area shall include testing and adjusting of pressure conditions.

.10 Complete balancing to achieve neutral to slight positive building pressure with respect to building entrance area. Positive pressure relative to outside of up to 2 Pa shall be achieved, measured with negligible outside wind velocity.

3.5 Adjusting of Domestic Water Systems

.1 Record PRV setting on main line.

3.6 Verification

.1 Reported results subject to verification by the Departmental Representative.

.2 Provide personnel and instrumentation to verify up to 30% of reported results.

.3 Number and location of verified results as directed by the Departmental Representative.

.4 Pay costs to repeat TAB as required to satisfaction of the Departmental Representative.

3.7 Settings

.1 After TAB is completed to satisfaction of the Departmental Representative, 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. Do not eradicate or cover markings.

3.8 Completion of TAB

.1 TAB is considered complete when final TAB Report received and all results are accepted by the Departmental Representative.

END OF SECTION

1. GENERAL

1.1 Section Scope

.1 Internal and external thermal duct insulation, accessories, sealers, and finishes.

1.2 Related Requirements

.1 This section of the Specification forms part of the Contract Documents and is to be read, interpreted, and coordinated with all other parts.

.2 Section 21 05 01 – Common Work Results for Mechanical.

1.3 References

.1 The latest revisions of the following standards shall apply unless noted otherwise.

.2 Applicable Building Code – Refer to Section 21 05 01 – Common Work Results for Mechanical

.3 Applicable energy code or standard – Refer to Section 21 05 01 – Common Work Results for Mechanical.

.4 Thermal Insulation Association of Canada (TIAC) – National Insulation Standards.

.5 British Columbia Insulation Contractors Association (BCICA) – Quality Standard for Mechanical Insulation Manual.

.6 CAN/ULC S102-M88 – Method of Test for Surface Burning Characteristics of Building Materials and Assemblies

.7 CGSB 51-GP-52MA – Vapour Barrier, Jacket and Facing Material for Pipe, Duct and Equipment Thermal Insulation

.8 ASTM C612 – Standard Specification for Mineral Fiber Block and Board Thermal Insulation

.9 ASTM C534 Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form.

.10 ASTM C553 – Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications

.11 ASTM C1071 - Standard Specification for Fibrous Glass Duct Lining.

.12 ASTM C1290 – Standard Specification for Flexible Fibrous Glass Blanket Insulation Used to Externally Insulate HVAC Ducts.

1.4 Submittals

.1 Comply with Division 01 – Submittal Procedures and Closeout Procedures, Section 21 05 01 Common Work Results for Mechanical – Submittals and in addition the following:

.1 Certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.2 Manufacturer's installation instructions.

1.5 General Requirements

.1 The Installation firm shall be a current member of one of the following:

.1 Thermal Insulation Association of Canada (TIAC).

.2 British Columbia Insulation Contractors Association (BCICA).

.3 Thermal Insulation Association of Alberta (TIAA).

.2 Only Journeyman insulation applicators, with 3 years minimum successful experience in this size and type of project, shall perform the work.

.3 Definitions:

.1 "CONCEALED" insulated mechanical services in trenches, chases, furred spaces, shafts and hung ceilings (services in tunnels are not considered to be concealed.)

.2 "EXPOSED" will mean not concealed.

.3 “K” value means Thermal Conductivity

.4 “UNCONDITIONED SPACE” referred to in the duct thickness tables are crawlspaces (vented or not vented), parkades, warehouse space, shipping and receiving areas and other areas noted on the drawings.

.5 “EXTERIOR SPACE” referred to in the duct thickness tables are all spaces outside the building insulation envelope, including attic spaces, unless noted otherwise.

.6 UL GREENGUARD: Provides independent third-party, Indoor Air Quality (IAQ) certification of products for emissions of respirable particles and Volatile Organic Compounds (VOC's), including formaldehyde and other specific product-related pollutants. Certification is based upon criteria used by Environmental Protection Agency (EPA), Occupational Safety and Health Administration (OSHA) and World Health Organization (WHO).

.7 ASJ: All Service Jacket composed of aluminum foil reinforced with glass scrim bonded to a kraft paper

.8 SSL: Self-Sealing Lap.

.9 FSK: Foil Scrim Kraft; jacketing.

.10 PSK: Poly Scrim Kraft; jacketing.

.11 PVC: PolyVinyl Chloride.

.4 Unless otherwise specified, insulation system materials inside building must have a fire hazard rating of not more than 25 for flame spread and 50 for smoke developed when tested in accordance with ULC S102, Surface Burning Characteristics of Building Materials, and Assemblies.

.5 Provide thermal insulation on all HVAC ductwork and as follows:

.1 Heating only duct and plenum – service temperature 20°C to 65°C

.2 Cooling only or combined cooling and heating duct and plenum - service temperature 5°C to 65°C

.3 Outside air duct and plenum - -40°C to ambient

.4 All exhaust air ductwork from outside wall or roof to damper but a minimum of 3 m inside building.

.5 Combustion intake / relief air

.6 Supply and return ductwork exposed in the space being served does not require insulation unless noted otherwise.

.7 Where an internal duct liner is used in lieu of external insulation, the internal thickness shall match that of the “Rigid Exterior Duct Insulation” table.

.6 Provide acoustic internal insulation on ductwork as follows:

.1 All ductwork indicated on drawings with cross hatching.

.2 All exposed supply and return ductwork in mechanical rooms from fan discharge to duct shaft or mechanical room perimeter wall.

.3 Where internal insulation is required, external insulation may be reduced or omitted by an equivalent thickness.

.7 If the Contractor, during renovations, should discover asbestos (or material suspected to be asbestos) on piping, ductwork, etc., he shall immediately cease all work in that area and contact the Departmental Representative.

.8 Make good all existing insulation disturbed or removed to facilitate alterations and additions to existing piping.

2. PRODUCTS

2.1 General

.1 Products shall not contain asbestos, lead, mercury, mercury compounds or Polybrominated diphenyl ethers (PBDE).

.2 Mineral fibre specified includes glass wool and rock wool.

.3 The RSI value shall not be reduced from the specified values when tested in accordance with ASTM C1290.

.4 Insulation and jacketing materials shall not exceed 25 flame spread, 50 smoke developed rating when tested in accordance with CAN/ULC S102-M88.

.5 Elastomeric insulation shall comply with NFPA 90A, 90B and ASTM C1534

.6 Foam insulation products shall not use CFC or HCFC blowing agents in the manufacturing process and be formaldehyde free.

.7 Glass mineral wool products shall have a recycled content of a minimum of 50 percent recycled glass content.

.8 Low Emitting Materials: For all thermal and acoustical applications of glass mineral wool insulation, insulation shall be UL GREENGUARD Certified.

2.2 Intermediate Temperature Range Insulation

.1 External rigid Insulation (TIAC C-1):

.1 Service temperature 5°C to 232°C

.2 Glass mineral wool board for low and medium temperature applications.

.3 Complying with ASTM C1071 and CGSB 51-GP-52MA

.4 All service aluminum foil-scrim kraft (FSK) jacket with glass fibre reinforcement, factory applied.

.5 Density 36kg/m^3

.6 Minimum RSI 0.76/25mm

.2 External flexible duct wrap insulation (TIAC C-2):

.1 Service temperature 5°C to 121°C

.2 For service temperatures above 121°C refer to 2.4 High Temperature Insulation

.3 Glass mineral wool flexible blanket for low and medium temperature applications.

.4 Complying with CGSB 51-GP-52MA, ASTM C1071 and ASTM C553.

.5 All service aluminum foil-scrim kraft (FSK) jacket with glass fibre reinforcement, factory applied.

.6 Density 12kg/m^3,

.7 Minimum RSI 0.49/25mm (installed)

.3 Internal rigid duct liner:

.1 Rigid glass mineral wool board, for low and medium temperature acoustical applications.

.2 Complying with ASTM C1071 and CGSB 51-GP-52MA

.3 Airstream surface faced with a black mat bonded to the glass mineral wool substrate.

.4 Air velocity rating 25.4 m/s

.5 Density 48kg/m^3,

.6 Minimum RSI 0.76/25mm

.7 Insertion loss:

Thickness		**Frequency (Hz.)**						
mm	inches	125	250	500	1000	2000	4000	NRC
25	1	0.13	0.24	0.56	0.83	0.92	0.98	0.65
40	1.5	0.19	0.41	0.89	1.02	1.03	1.04	0.85
50	2	0.33	0.67	1.07	1.07	1.03	1.06	0.95

.4 Internal flexible duct liner:

.1 Flexible glass mineral wool blanket, for low and medium temperature acoustical applications.

.2 Complying with CGSB 51-GP-52MA, ASTM C1071 and ASTM C553.

.3 Airstream surface faced with non-woven fiberglass mat bonded to the glass mineral wool substrate.

.4 Air velocity rating 25.4 m/s

.5 Density 24kg/m^3

.6 Minimum RSI 0.74/25mm

.7 Insertion loss:

Thickness		**Frequency (Hz.)**						
mm	inches	125	250	500	1000	2000	4000	NRC
25	1	0.18	0.36	0.59	0.86	0.95	0.9	0.7
40	1.5	0.35	0.51	0.83	0.93	0.97	0.96	0.8
50	2	0.34	0.64	0.96	1.03	1	1.03	0.9

2.3 Fastenings, Adhesives and Coatings

.1 Insulation Fastenings:

.1 Min. 1.6 mm thick galvanized wire , 0.6 mm thick aluminium wire, 0.6 mm thick type 304 stainless steel wire or 1.6 mm thick copper wire.

.2 Mechanical fasteners, welded fasteners or adhesive fasteners to meet SMACNA HVAC Duct Construction Standard for mechanical fasteners.

.2 Corner Beads: Galvanized steel or aluminum 38 mm x 38 mm x 0.37 mm thick.

.3 Jacket Fastenings:

.1 Thermocanvas and All Service Jacket: Staples (flare type), compatible jacket finishing tape, contact adhesives recommended by the jacket manufacturer.

.2 Metal Jackets: Sheet metal screws, pop rivets.

.4 Adhesives:

.1 Fabric adhesive to insulation covering, water based, ultra white, washable, anti-microbial.

.2 Internal elastomeric insulation adhesive shall be as per manufacturer's recommendations.

.5 Coatings: Vapour barrier coating on reinforcing membrane.

2.4 Finish Jackets

.1 Thermocanvas Jacket: fire rated, 170g fire retardant canvas jacket for covering mechanical insulation indoors, 25/50 fire class, plain wave cotton, no dyes.

.2 Aluminum Jacket: 0.7 mm thick stucco or smooth aluminum jacketing with longitudinal slip joints and 50mm end laps with factory applied protective liner on interior surface.

3. EXECUTION

3.1 General

.1 Installation shall be to Thermal Insulation Association of Canada (TIAC): National Insulation Standards and the following:

3.2 Rigid Insulation External Application

.1 Heating only Duct and Plenum – Service Temperature 20° to 65°C (CER/1)

.1 Fix mechanical fasteners to both horizontal and vertical surfaces at approximately 300 mm centers, each direction.

.2 Provide insulation without integral vapor retarder with horizontal surfaces overlapping vertical surfaces and edges tightly butted together. Secure insulation by impaling on mechanical fasteners.

.3 In areas of limited space wire fastenings, insulation adhesive, or other suitable methods of attachment may be substituted.

.2 Cooling only or Combined Cooling and Heating Duct and Plenum - Service Temperature 5°C to 65°C (CER/2)

.1 Fix mechanical fasteners to both horizontal and vertical surfaces at approximately 300 mm centers, each direction.

.2 Install vapor retarder toward the ambient atmosphere with horizontal surfaces overlapping vertical surfaces tightly butted together. Secure insulation by impaling on mechanical fasteners.

.3 Where mechanical fasteners penetrate vapor retarder, and at all corners and joints, apply self adhesive vapor retarder tape or vapor retarder strips adhered with vapor retarder adhesive. Where raised seams are encountered, add a strip of insulation above seam termination on each side of the seam, secure to the seams an overlapping strip of insulating material of equal thickness to the one required to provide a continuous vapor retarder. Seal all joints and edges with self adhesive vapor retarder tape.

.4 In areas of limited space wire fastenings, insulation adhesive, or other suitable methods of attachment may be substituted.

.3 Outside Air Duct and Plenum - -40°C to Ambient (CER/3)

.1 As per CER/2 application but firstly apply a layer of rigid insulation without vapor retarder before applying layer of rigid insulation with vapor retarder. All joints shall be staggered.

3.3 Flexible Insulation External Application

.1 Heating only Duct and Plenum – Service Temperature 20°C to 65°C (CEF/1)

.1 On rectangular ducts ≥ 600mm in width, apply mechanical fasteners to the bottom surface at approximately 300 mm centres.

.2 Apply insulation without integral vapour retarder with 50 mm overlap at each joint. Secure insulation with wire fastening on approximately 300 mm centres, or by stapling laps.

.2 Cooling only or Combined Cooling and Heating Duct and Plenum – Service Temperature 5°C to 65°C (CEF/2)

.1 On rectangular ducts ≥ 600 mm in width, apply to bottom surface mechanical fasteners at approximately 300 mm centers.

.2 Apply insulation with vapor retarder to the outside.

.3 Where mechanical fasteners or staples penetrate the vapor retarder and at all joints apply vapor retarder tape or vapor retarder strips adhered with vapor retarder adhesive.

.4 All joints shall be overlapped a minimum of 50 mm and stapled on approximately 100 mm centers.

.5 Secure insulation with wire fastening on approximately 300 mm centers.

.3 Heating only Duct and Plenum Fire Barrier – ambient to 538°C

.1 As per manufacturers installation instructions

3.4 Duct Insulation Minimum Thickness Table (Climatic Zone 5)

Rigid Exterior Duct Insulation				
Duty	**Plenum-Concealed (4)**	**Duct Location**		
		Interior		**Exterior**
		Conditioned Space	Unconditioned Space	

	Minimum Insulation Thickness in mm			
Cooling Only Air Supply	25	25	25	125
Heating or H/C Air Supply	38	38	38	125
Outdoor Air Supply	38	38	38	0
Combustion Air	38	38	38	0
Return Air	25	0	25	125
Exhaust Air (1)(2)	25	0	25	25
Grease Hood Exhaust (5)	N/A	38	38	0
Tempered Air Supply or Makeup Air	0	0	25	125
Mixed Air (3)	25	25	25	125
See note (6) for factory installed duct and plenums				

Flexible Exterior Duct Insulation				
Duty	**Plenum-Concealed (4)**	**Duct Location**		
		Interior		**Exterior**
		Conditioned Space	Unconditioned Space	
	Minimum Insulation Thickness mm			
Cooling Only Air Supply	38	38	38	188
Heating or H/C Air Supply	50	50	50	188
Outdoor Air Supply	50	50	50	0
Combustion Air	50	50	50	0
Return Air	38	0	38	188
Exhaust Air (1)(2)	38	0	38	38
Grease Hood Exhaust (5)	N/A	38	38	0
Tempered Air Supply or Makeup Air	0	0	38	188
Mixed Air (3)	38	38	38	188
See note (6) for factory installed duct and plenums				

Note (1): Air temperatures 15°C to 49°C

Note (2): Provide 38mm flexible duct insulation on all exhaust air ductwork from outside wall or roof to damper but a minimum of 1.5 m inside building.

Note (3): Mixed Air includes tempered air downstream of heat recovery units

Note (4): Plenums located outside the building shall be insulated to the values listed in the exterior column.

Note (5): Provides 1 hour fire rating. Thickness shall be doubled for 2 hour applications

Note (6): Factory installed ductwork and plenums provided with equipment need not comply with this table provided they meet the requirements of the relevant CSA Standard for that equipment and is insulated to RSI 0.58 or greater. Refer to NECB article 5.2.12.1 for relevant CSA Standards.

3.5 Liner Internal Application

.1 General

.1 Where an interior duct liner is used, external insulation shall not be applied unless noted otherwise.

.2 Where an interior duct liner is used, the thickness shall be selected to match the thickness specified for external rigid insulation. Where no external insulation is required internal acoustic duct liner shall be a minimum 25mm.

.2 Rigid Duct Liner (CIR/1)

.1 Fix mechanical fasteners to both horizontal and vertical surfaces at approximately 300 mm centers each direction.

.2 Apply insulation with surfaces overlapping vertical surfaces and with edges tightly butted together.

.3 Insulation shall be applied to the ductwork with a minimum 90% coverage of adhesive and mechanical fasteners.

.4 Where mechanical fasteners penetrate factory finish and at all joints, apply a heavy layer of seal coating.

.5 On high velocity duct systems 20 m/s to 30 m/s apply reinforcing membrane over the entire insulation joint surface.

.6 Seal off leading edge of insulation to duct surface on low velocity ductwork with reinforced seal coating or metal nosing. On high velocity duct systems, (over 20 m/s) use metal nosing.

.3 Flexible Duct Liner (CIF/1)

.1 Fix mechanical fasteners to both horizontal and vertical surfaces at approximately 300 mm centers each direction.

.2 Apply insulation with edges tightly butted together.

.3 Insulation shall be applied to the ductwork with a minimum 90% coverage of adhesive and mechanical fasteners.

.4 Where mechanical fasteners penetrate factory finish and at all joints, apply a heavy layer of seal coating.

.5 On high velocity duct systems 20 m/s to 30 m/s apply reinforcing membrane over the entire insulation joint surface.

.6 Seal off leading edge of insulation to duct surface on low velocity ductwork with reinforced seal coating or metal nosing. On high velocity duct systems, (over 20 m/s) use metal nosing.

3.6 External Flexible Fire Barrier Insulation

.1 Install as per manufacturers installation instructions.

3.7 Finishes

.1 General

.1 Insulation on concealed ductwork shall be left with factory finish. No further finish is required.

.2 The following finishes apply to exposed ductwork and plenums only.

.2 Utility Finish – Indoor (CRF/2) (CRD/2)

.1 Use over rigid insulation for rectangular ductwork and flexible insulation for round ductwork, all with an integral vapor retarder. Apply continuous metal corner bead to all corners. Adhere vapor retarder tape over all joints and breaks in vapor retarder, and at all corners.

3.8 Duct Finishes Table

.1 Conform to the following:

Duty	Rectangular Duct		Round Duct	
	Type	TIAC Code	Type	TIAC Code
Indoor Concealed	None	None	None	None
Indoor Exposed in Utility Areas, Etc.	Utility Finish	CRF/2	Utility Finish	CRD/2
Outdoor Exposed to Precipitation	Aluminum Jacket	CRF/3	Aluminum Jacket	CRD/3

END OF SECTION

1. GENERAL

1.1 Section Scope

.1 Section includes commissioning process requirements for HVAC&R and plumbing systems, assemblies, and equipment.

1.2 Related Requirements

.1 This section of the Specification forms part of the Contract Documents and is to be read, interpreted, and coordinated with all other parts.

.2 Section 21 05 01 – Common Work Results for Mechanical.

1.3 References

.1 Commissioning Agency (CxA)

.2 The latest revisions of the following standards shall apply unless noted otherwise.

.1 Applicable Building Code - Refer to Section 21 05 01.

.2 CSA Z320-11 (R2016) Building Commissioning Standard.

.3 ANSI/ASHRAE/IES Standard 202-2018 Commissioning Process for Buildings and Systems.

1.4 Submittals

.1 Comply with Division 1 – Submission and Closeout Procedures, Section 21 05 01 Common Work Results for Mechanical – Submittals and in addition the following:

.1 Certificates of readiness.

.2 Certificates of completion of installation, prestart, and start-up activities.

1.5 Installation/Start-Up Check Lists

.1 Include the following data:

.1 Product manufacturer's installation instructions and recommended checks.

.2 Special procedures as specified in relevant technical sections.

.3 Items considered good installation and engineering industry practices deemed appropriate for proper and efficient operation.

.2 Equipment manufacturer's installation/start-up check lists are acceptable for use. As deemed necessary by Departmental Representative supplemental additional data lists will be required for specific project conditions.

.3 Use check lists for equipment installation. Document check list verifying checks have been made, indicate deficiencies and corrective action taken.

.4 Installer to sign check lists upon completion, certifying stated checks and inspections have been performed. Return completed check lists to Departmental Representative. Check lists will be required during Commissioning and will be included in Building Maintenance Manual (BMM) at completion of project.

.5 Use of check lists will not be considered part of commissioning process but will be stringently used for equipment pre-start and start-up procedures.

1.6 Contractor's Responsibilities

.1 Perform commissioning tests.

.2 Attend construction phase controls coordination meeting as required.

.3 Attend testing, adjusting, and balancing review and coordination meeting.

.4 Participate in HVAC&R systems, assemblies, equipment, and component maintenance orientation and inspection.

.5 Provide information requested by the CxA for the final commissioning documentation.

.6 Provide measuring instruments and logging devices to record test data, and provide data acquisition equipment to record data for the complete range of testing for the required test period.

1.7 CxA's Responsibilities

.1 Provide Project-specific construction checklists and commissioning process test procedures for actual HVAC&R and plumbing systems, assemblies, equipment, and components to be furnished and installed as part of the construction contract.

.2 Verify and participate in commissioning testing.

.3 Verify testing, adjusting, and balancing of work are complete.

1.8 Extent of Cx

.1 Commission mechanical systems and associated equipment:

- .1 Plumbing systems:
  - .1 Domestic CWS and HWS.
  - .2 Regular sanitary waste systems.
- .2 HVAC and exhaust systems:
  - .1 Heat recovery systems HRV-1 and HRV-2 and other equipment scheduled on drawings.
- .3 Noise and vibration control systems for mechanical systems.
  - .1 HRV-1 and HRV-2 and other equipment scheduled on drawings.
- .4 Seismic restraint and control measures.
  - .1 HRV-1 and HRV-2.
- .5 Controls:
  - .1 For new HRV-1 and HRV-2 and other equipment scheduled on drawings.

.2 Commission electrical systems and equipment:

- .1 Low voltage below 750 V:
  - .1 New low voltage equipment.
  - .2 New low voltage distribution systems.
  - .3 Relocated baseboard heater.

1.9 Commissioning Documentation

.1 Provide the following information to the CxA for the inclusion in the commissioning plan:

- .1 Plan for delivery and review of submittals, systems manuals, and other documents and reports.

.2 Identification of installed systems, assemblies, equipment, and components including design changes that occurred during the construction phase.

.3 Process and schedule for completing construction checklists for HVAC&R systems, assemblies, equipment, and components to be verified and tested.

.4 Certificate of completion certifying that installation, start-up checks, and start-up procedures have been completed.

.5 Certificate of readiness, certifying that HVAC&R and plumbing systems, subsystems, equipment, and associated controls are ready for testing.

.6 Test and inspection reports, and certificates.

.7 Corrective action documents.

.8 Documented verification of testing, adjusting, and balancing reports.

2. PRODUCTS (NOT USED)

3. EXECUTION

3.1 Testing Preparation

.1 Certify that HVAC&R and plumbing systems, subsystems, and equipment, have been installed, calibrated, and started and are operating according to the Contract Documents.

.2 Construction documents review:

.1 Provide full set of Div 21, 22, 23, 25, 26 drawings and specifications for preliminary design review.

.3 Certify that HVAC&R, instrumentation, and control systems have been completed and calibrated, that they are operating according to the Contract Documents, and that pretest set points have been recorded.

.4 Certify that testing, adjusting, and balancing procedures have been completed and that testing, adjusting, and balancing reports have been submitted, discrepancies corrected, and corrective work approved.

.5 Set systems, subsystems, and equipment into operating mode to be tested (e.g., normal shutdown, normal auto position, normal manual position, unoccupied cycle, and alarm conditions).

.6 Inspect and verify the position of each device and interlock identified on checklists.

.7 Check safety cut-outs, alarms, and interlocks with life-safety systems during each mode of operation.

.8 Testing instrumentation: Install measuring instruments and logging devices to record test data as required.

3.2 Testing and Balancing Verification

.1 Prior to performance of testing and balancing (TAB) work, provide copies of TAB procedures, reports, sample forms, checklists, and certificates to the CxA.

.2 Notify the CxA at least 10 working days in advance of testing and balancing work, and provide access for the CxA and Departmental Representative to witness testing and balancing work.

.3 Contractor's Cx Agent to be present at tests performed and documented by sub-trades, suppliers and equipment manufacturers.

.4 Provide technicians, instrumentation, and tools to verify testing and balancing of HVAC&R systems.

.1 The CxA will notify testing and balancing Contractor 10 working days in advance of the date of field certification. Notice will not include data points to be verified.

.2 The testing and balancing Contractor shall use the same instruments (by model and serial number) that were used when original data were collected.

.3 Failure of an item includes, other than for sound measurements, a deviation of more than 10 percent. Failure of more than 10 percent of selected items shall result in rejection of final testing, adjusting, and balancing report. For sound pressure readings, a deviation of 3dB shall result in rejection of final testing.

.4 Remedy the deficiency and notify the CxA so verification of failed portions can be performed.

3.3 General Testing Requirements

.1 Scope of HVAC&R testing includes entire new HRV installations, from new equipment through distribution systems to each ventilated space. Testing includes confirming that the relocated baseboard heater remains functional. Testing shall include measuring capacities and effectiveness of operational and control functions.

.2 Test all operating modes, interlocks, control responses, and responses to abnormal or emergency conditions, and verify proper response of building automation system controllers and sensors.

.3 The CxA along with the HVAC&R Contractors, testing and balancing Contractor, and the HVAC&R Instrumentation and Control Contractor shall prepare detailed testing plans, procedures, and checklists for HVAC&R systems, subsystems, and equipment.

.4 Tests will be performed using design conditions whenever possible.

.5 Simulated conditions may need to be imposed using an artificial load when it is not practical to test under design conditions. Calibrate testing instruments before simulating conditions. Provide equipment to simulate loads. Set simulated conditions and document simulated conditions and methods of simulation. After tests, return settings to normal operating conditions.

.6 Alter sensor values with a signal generator when design or simulating conditions and altering set points are not practical.

.7 If tests cannot be completed because of a deficiency outside the scope of the HVAC&R system, document the deficiency and report it to the Departmental Representative. After deficiencies are resolved, reschedule tests.

.8 If the testing plan indicates specific seasonal testing, complete appropriate initial performance tests and documentation and schedule seasonal tests.

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

3.4 HVAC&R Systems, Subsystems, and Equipment Testing Procedures

.1 Heating system impacted by the renovation, the new HRVs and exhaust fans.

.2 HVAC&R Distribution System and Testing: Provide technicians, instrumentation, tools, and equipment, to test performance of air systems and other distribution systems, including HVAC&R terminal equipment and unitary equipment.

3.5 Procedures for Space Pressurization Measurements and Adjustments

.1 Before testing for space pressurization, observe the space to verify the integrity of the space boundaries. Verify that windows and doors are closed and applicable gaskets, and sealants are installed. Report deficiencies and postpone testing until after the reported deficiencies are corrected.

.2 Measure, adjust, and record the pressurization of each room, each zone, by adjusting the supply and exhaust airflows to achieve the indicated conditions.

.3 Measure airflow differential where differential airflow is used as the design criteria for space pressurization.

.4 To achieve indicated pressurization, set the supply airflow to the indicated conditions and adjust the exhaust airflow to achieve the indicated pressure of airflow difference.

.5 Record indicated conditions and corresponding initial and final measurements. Report deficiencies.

3.6 Commissioning of Plumbing Systems

.1 Provide commissioning of all plumbing piping, equipment, and systems including the following:

.1 Domestic cold water.

.2 Domestic hot water.

.3 Sanitary waste and venting.

.2 Commissioning related to plumbing systems shall include the start-up, set up, adjustment, and recording of the operational data of at least all of the following systems and components as related to the project:

.1 Incoming municipal water pressure.

.2 Pressure reducing valve set points and downstream pressures.

.3 Central and individual tempered water mixing valve set points.

.4 Setting of all temperature limit stops on all shower valves with maximum temperatures recorded for each fixture.

.5 Operation of all plumbing fixtures including adjustments of all flush valves.

.6 Set points for all control devices.

END OF SECTION

1. GENERAL

1.1 Section Scope

.1 Electric/electronic line voltage and low voltage electric/electronic standalone non-BAS control for HVAC (this could range from as simple as programmable thermostat up to stand- alone local controller, project specific).

1.2 Related Requirements

.1 This section of the Specification forms part of the Contract Documents and is to be read, interpreted, and coordinated with all other parts.

.2 Section 21 05 01 – Common Work Results for Mechanical.

.3 Section 23 72 00 Air-to-Air Energy Recovery Equipment.

.4 Division 26 – Electrical.

1.3 References

.1 The latest revisions of the following standards shall apply unless noted otherwise.

.1 Applicable Building Code - Refer to Section 21 05 01 – Common Work Results for Mechanical.

.2 British Columbia Codes:

.1 British Columbia Electrical Code.

.2 British Columbia Safety Authority.

1.4 Coordination of Work

.1 Products furnished but not installed under this Section:

.1 Division 23 – Heating, Ventilation, and Air Conditioning:

.1 Automatic Damper Actuators.

.2 Terminal Unit Controls.

.2 Work Scope by Control Contractor (Division 23):

.1 All control system components to make a complete and operable system, except those supplied as part of packaged equipment controls, but including all auto-sequencing devices and electrical interlocks required to accomplish the sequences specified. Refer to the electrical equipment schedule, the electrical drawings, and the electrical specification, which describes the limits of the extent to the work in Division 26 serving mechanical systems. Materials, equipment, connections, and power not provided by Division 26 but required for the Control System shall be provided under this section.

.2 All control circuit transformers (120/1/60 or 24/1/60 and as designated).

.3 All control wiring and metallic conduit for mechanical system controls.

.4 Supply, installation, and connection of all electric control items including: damper actuators, relays, control circuits, safety devices, electric thermostats, wiring to terminal strips, controllers, etc.

.5 All wiring and conduit from power distribution system to any control devices needing power

.6 Be responsible for coordinating with Division 26.

.7 Electrical work installed under Division 23 shall be to the standards specified under Division 26.

1.5 Submittals

.1 Comply with Division 01 – Submittal Procedures and Closeout Procedures, Section 21 05 01 Common Work Results for Mechanical – Submittals and in addition the following:

.2 Provide submittals on all hardware and installation. No work may begin on any segment of this project until submittals have been successfully reviewed for conformity with the design intent. Provide drawings as files on optical disk (file format: .dwg, .dxf, pdf, or comparable). When manufacturer's cut sheets apply to a product series rather than a specific product, the data specifically applicable to the project shall be highlighted or clearly indicated by other means. Each submitted piece of literature and drawings shall clearly reference the specification and/or drawing that the submittal is to cover. General catalogs shall not be accepted as cut sheets to fulfill submittal requirements. Submittals shall include a complete bill of materials of equipment to be used indicating quantity, manufacturer, model number, and other relevant technical data and the following:

.1 Manufacturer's description and technical data, product specification sheets, and installation/maintenance instructions for:

.1 Thermostats.

.2 Actuators.

.3 Relays/Switches.

2. PRODUCTS

2.1 Heat Recovery Ventilator Controls

.1 Low voltage wall mounted controller as supplied with each heat recovery ventilator. Refer to Section 23 72 00 Air-to-Air Energy Recovery Equipment for product requirements.

2.2 Voltage Transformers

.1 AC voltage transformers shall be UL/CSA Recognized, 600 VAC rated, complete with built-in fuse protection.

.2 Transformers shall be suitable for ambient temperatures of 4°C to 55°C and shall provide ±0.5% accuracy at 24 VAC and a 5 VA load.

.3 Windings (except for terminals) shall be completely enclosed with metal or plastic material.

2.3 Control Relays

.1 Control pilot relays: modular plug-in design with snap-mount mounting bases, retaining springs or clips, DPDT, 3 PDT or 4 PDT as required for the application, with contacts rated for 10 amperes at 120 VAC.

2.4 Control Dampers and Operators

.1 100 mm deep, flanged, AMCA low leakage certified aluminum dampers. Dampers for modulating and mixing applications are to be parallel blade type. Dampers for open-shut service are to be opposed blade type. Maximum blade length is to be 1 m (4'). Dampers greater than 2 sections wide are to be complete with a jackshaft. Each damper is to be complete with:

.1 extruded 6063T5 aluminum frame and airfoil blades, each with an integral slot to receive a gasket;

.2 extruded TPE frame gaskets and extruded EPDM blade gaskets;

.3 slip-proof aluminium and corrosion resistant plated steel linkage of a metal thickness to prevent warping or bending during damper operation, concealed in frame, equipped with seal-sealing and self-lubricating bearings consisting of a Celcon inner bearing fixed on hexagonal blade pin and rotating in a polycarbonate outer bearing inserted in frame.

.2 For standard damper(s), as above.

.3 For insulated damper(s), as above but with all 4 sides of frame insulated with polystyrene, and blades thermally broken and insulated with expanded polyurethane foam.

.4 For stainless steel dampers, as above but constructed of type 316 stainless steel and equipped with Teflon blade bearings.

.5 Each damper motor is to be shaft mounted, spring return, fail safe in the normally open or normally closed position, sized to control damper against maximum pressure or dynamic closing pressure, whichever is greater, to suit sizes of dampers involved, and to provide sufficient force to maintain damper rated leakage characteristics. Each operator is to be complete with a damper position indicator, and external adjustable stops to limit length of stroke in either direction, and is to be mounted on a corrosion resistant adjustable bracket. Operating arms are to have double yoke linkages and double set screws for fastening to damper shaft. Operators for dampers to be connected to freeze protection devices are to be equipped with additional relays to permit dampers to respond and go to required position in less than 15 seconds upon receipt of a signal. Operator enclosures are to be suitable in all respects for environment in which they are located.

.1 Electric damper operators are to be 24 volt or 120 volt AC spring return, direct coupled electric motor operators for either modulating or 2-position control as required. Each operator is to be overload protected and complete with an enclosure to suit the mounting location.

2.5 Wiring and Raceways

.1 General: Provide copper wiring, plenum cable, and raceways as specified in the applicable sections of Division 26.

.2 All insulated wire to be copper conductors, UL labeled for 90°C minimum service.

3. EXECUTION

3.1 Verification of Conditions

.1 Verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for electric and electronic control systems installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate.

.2 Inform the Departmental Representative of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied.

3.2 General Installation

.1 On outside wall, mount thermostats on bracket or insulated pad 25 mm from exterior wall.

.2 Install remote sensing device and capillary tube in metallic conduit. Conduit enclosing capillary tube must not touch heater or heating cable.

3.3 Wiring

.1 All control and interlock wiring shall comply with national and local electrical codes and Division 26 of this specification. Where the requirements of this section differ from those in Division 26, the requirements of this section shall take precedence.

.2 All NEC Class 1 (line voltage) wiring shall be UL Listed in approved raceway according to NEC and Division 26 requirements.

.3 All low-voltage wiring shall meet NEC Class 2 requirements. (Low-voltage power circuits shall be subfused when required to meet Class 2 current limit.)

.4 Where NEC Class 2 (current-limited) wires are in concealed and accessible locations, including ceiling return air plenums, approved cables not in raceway may be used provided that cables are UL Listed for the intended application. For example, cables used in ceiling plenums shall be UL Listed specifically for that purpose.

.5 All wiring in mechanical, electrical, or service rooms—or where subject to mechanical damage— shall be installed in raceway at levels below 3 m.

.6 Do not install Class 2 wiring in raceway containing Class 1 wiring. Boxes and panels containing high-voltage wiring and equipment may not be used for low-voltage wiring except for the purpose of interfacing the two (e.g., relays and transformers).

.7 Do not install wiring in raceway containing tubing.

.8 Where Class 2 wiring is run exposed, wiring is to be run parallel along a surface or perpendicular to it and neatly tied at 3 m intervals.

.9 Where plenum cables are used without raceway, they shall be supported from or anchored to structural members. Cables shall not be supported by or anchored to ductwork, electrical raceways, piping, or ceiling suspension systems.

.10 All wire-to-device connections shall be made at a terminal block or terminal strip. All wire-to-wire connections shall be at a terminal block.

.11 All wiring within enclosures shall be neatly bundled and anchored to permit access and prevent restriction to devices and terminals.

.12 Maximum allowable voltage for control wiring shall be 120 V. If only higher voltages are available, the contractor shall provide step-down transformers.

.13 All wiring shall be installed as continuous lengths, with no splices permitted between termination points.

.14 Size of raceway and size and type of wire shall be the responsibility of the contractor, in keeping with the manufacturer’s recommendations and NEC requirements, except as noted elsewhere.

.15 Include one pull string in each raceway 2.5 cm or larger.

.16 Use coded conductors throughout with conductors of different colors.

.17 Control and status relays are to be located in designated enclosures only. These enclosures include packaged equipment control panel enclosures unless they also contain Class 1 starters.

.18 Conceal all raceways, except within mechanical, electrical, or service rooms. Install raceway to maintain a minimum clearance of 15 cm from high-temperature equipment (e.g., steam pipes or flues).

.19 Secure raceways with raceway clamps fastened to the structure and spaced according to code requirements. Raceways and pull boxes may not be hung on flexible duct strap or tie rods. Raceways may not be run on or attached to ductwork.

.20 Install insulated bushings on all raceway ends and openings to enclosures. Seal top end of all vertical raceways.

.21 The Contractor shall terminate all control and/or interlock wiring and shall maintain updated (as-built) wiring diagrams with terminations identified at the job site.

.22 Flexible metal raceways and liquid-tight, flexible metal raceways shall not exceed 1 m in length and shall be supported at each end. Flexible metal raceway less than 12mm. Electrical trade size shall not be used. In areas exposed to moisture, liquid-tight, flexible metal raceways shall be used.

.23 Raceway must be rigidly installed, adequately supported, properly reamed at both ends, and left clean and free of obstructions. Raceway sections shall be joined with couplings (according to code). Terminations must be made with fittings at boxes, and ends not terminating in boxes shall have bushings installed.

END OF SECTION

1. GENERAL

1.1 Section Scope

.1 Materials and installation of low-pressure metallic ductwork, flexible ductwork, joints and accessories.

1.2 Related Requirements

.1 This section of the Specification forms part of the Contract Documents and is to be read, interpreted, and coordinated with all other parts.

.2 Section 21 05 01 – Common Work Results for Mechanical

.3 Section 23 33 00 – Duct Accessories

1.3 References

.1 The latest revisions of the following standards shall apply unless noted otherwise.

.1 National Fire Protection Association (NFPA)

.1 NFPA 90A, Standard for the Installation of Air Conditioning and Ventilating Systems.

.2 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA).

.1 SMACNA - HVAC Duct Construction Standards - Metal and Flexible.

.2 SMACNA - HVAC Air Duct Leakage Test Manual.

1.4 Submittals

.1 Comply with Division 01 – Submittal Procedures and Closeout Procedures, Section 21 05 01 Common Work Results for Mechanical – Submittals and in addition the following:

.1 Shop Drawings:

.1 Sealants, tapes, proprietary joints.

1.5 General Requirements

.1 Duct sizes on drawings indicate clear inside dimensions. For acoustically lined or internally insulated ducts, maintain inside duct dimensions.

.2 Where duct sizes are shown in nominal metric sizes, round and oval duct sizes may be supplied in nearest available sizes in equivalent imperial units.

.3 Provide openings of correct size and locations through slabs and walls. Openings shall be planned to include installation of fire dampers at all rated fire separations.

.4 Where ducts penetrate roofs, provide roof curbs with flashing, and counter flashing. Ensure that penetration details are reviewed by the Departmental Representative.

.5 The project drawings are diagrammatic and although efforts have been made to provide information regarding the number of offsets and transitions, not all are necessarily shown. Changes may be required in duct routings, elevation and duct shape to eliminate interference with structure and other services. All required adjustments shall be established when coordinating and field measuring the work prior to fabrication and must be provided as part of the contract and all associated costs must be considered and included.

.6 Ductwork shall be clean and free from scale, corrosion, and deposits. Ductwork shall be degreased and wiped clean of all oil and other surface films with appropriate solvents prior to installation.

.7 Ductwork shall be delivered clean to the site and maintained in clean condition. Dirty ductwork shall be removed from site.

.8 Where welded ductwork is indicated, the welding shall be continuous. Tack welding is unacceptable, except as specifically noted. Paint damaged areas with zinc coating after welding.

.9 In exposed ductwork installations, the contractor shall have a consistent ductwork fabrication methodology. Longitudinal seam ducts shall not be intermixed with spiral seamed ductwork. Slip joint seams shall not be intermixed with flanged type seams where practical. Shop drawing submittals shall also indicate the duct fabrication type - spiral seam versus longitudinal seam, and duct joining method etc.

.10 The contractor shall allow for the design, supply, and installation of all transition fittings required to connect ductwork to all mechanical equipment (both inlet and outlet connections). Where feasible, the fittings shall be fabricated per SMACNA standards in terms of maximum angles of convergence and divergence. Flexible connections shall be provided for all equipment / duct connections.

2. PRODUCTS

2.1 Ductwork and Plenum Pressures

.1 Provide ductwork constructed, reinforced, sealed and installed to withstand 1½ times the working static pressure

.2 Low Pressure Galvanized Steel Ductwork 500 Pa and under

.1 Supply ductwork and plenums on systems without terminal mixing boxes or air valves.

.2 Supply ductwork downstream from terminal mixing boxes or air valves.

.3 Outdoor air ductwork and plenums, unless noted otherwise.

.4 Return air ductwork and plenums, unless noted otherwise.

.5 Exhaust and relief air ductwork and plenums, unless noted otherwise.

.3 Low Pressure Flexible Ductwork 500 Pa and under

.1 Connect outlet terminals to low pressure ducts with 900mm maximum length of stretched flexible duct. Hold in place with strap or clamp, caulk sealed. Do not use flexible duct to change directions.

.2 Provide a flexible connection where low pressure ducts are connected to fan equipment, terminal boxes, or any other apparatus. Joint shall be screwed or bolted flexible gasketed joint, minimum 50mm wide.

2.2 Duct Sealing Galvanized Steel.

.1 Low Pressure Ductwork 500 Pa and under shall be SMACNA seal class A. Seal all supply, return and exhaust duct joints, longitudinal as well as transverse joints as follows:

.1 Slip Joints: Apply heavy brush-on high pressure duct sealant. Apply second application after the first application has completely dried out. Where metal clearance exceeds 1.5 mm use heavy mastic type sealant.

.2 Flanged Joints: Soft elastomer butyl or extruded form of sealant between flanges followed by an application of heavy brush-on high pressure duct sealant.

.3 Other Joints: Heavy mastic type sealant.

.2 Medium Pressure Ductwork to 1000 Pa shall be SMACNA seal class A. Seal all supply, return and exhaust duct joints, longitudinal as well as transverse joints as follows:

.1 Combination of woven fabrics and sealing compound followed by an application of high pressure duct sealant.

.3 Duct tapes as sealing method are not permitted, except on residential ductwork – minimum 2 wraps of 50mm wide foil duct tape is acceptable.

.4 Surfaces to receive sealant should be free from oil, dust, dirt, moisture, rust and other substances that inhibit or prevent bonding.

.5 Do not insulate any section of the ductwork until it has been inspected and approved of duct sealant application, by the Departmental Representative.

2.3 Rigid Ductwork - 500 Pa Static Pressure

.1 Provide galvanized steel ductwork for system operating pressures 500 Pa and less. Ductwork shall be constructed, reinforced, sealed, and installed to withstand 1½ times the working static pressure.

.2 Construct rectangular ductwork in accordance with SMACNA Duct Standards Section I.

.3 Nomasco "Ductmate System, Lockformer TDC” or Exanno "Nexus System" may be used for rectangular duct joints.

.4 Construct rectangular duct fittings in accordance with the SMACNA Duct Standards Section II.

.5 Construct round ductwork in accordance with the SMACNA Duct Standards Section III, but excluding beaded crimp joints and snaplock seams.

.6 Construct flat oval ductwork in accordance with the SMACNA Duct Standards Section III. Joints and seams shall be similar to those indicated for round ducts. Flat oval duct to be used for positive pressure application only.

.7 Construct round and flat oval duct fittings in accordance the SMACNA Duct Standards Section III. Round elbows shall have a centreline radius of 1.0 times duct diameter. Sheet metal gauge of fittings and elbows shall be not less than the thickness of that specified for longitudinal seam straight duct. Adjustable elbows are not permitted.

2.4 Flexible Plain Ductwork

.1 Minimum Requirements:

.1 Non-corrosive spiral wire reinforcing with flexible vinyl coated fiberglass cloth membrane.

.2 Rated for use up to 30.7 m/s air velocity

.3 Suitable for up to 2500 Pa positive static pressure and 500 Pa negative static pressure.

.4 U.L. or U.L.C. labelled, Class 1, duct connector.

.5 Flame spread rating not to exceed 25. Smoke developed rating not to exceed 50.

2.5 Flexible Insulated Ductwork

.1 Minimum Requirements:

.1 Flexible vinyl coated steel helix bonded to inner duct liner. Fibrous glass thermal insulation.

.2 Outer jacket of metalized fire-resistant vapour barrier.

.3 Rated for use up to 30.7 m/s air velocity

.4 Suitable for up to 2500 Pa positive static pressure and 500 Pa negative static pressure.

.5 UL or ULC labelled, Class 1, duct connector.

.6 Flame spread rating not to exceed 25. Smoke developed rating not to exceed 50.

.7 Acoustically rated.

2.6 Metallic Fittings

.1 Fabrication: to SMACNA HVAC Duct Construction Standards - Metal and Flexible, latest edition.

.2 Radius elbows.

.1 Rectangular: standard radius with single thickness turning vanes Centreline radius: 1.5 times width of duct.

.2 Round: smooth radius piece.

.1 Centreline radius: 1.5 times diameter for ductwork 750 Pa and greater

.2 Centreline radius: 1 times diameter for ductwork 500 Pa and less.

.3 Mitred elbows, rectangular:

.1 Install mitred elbows where space will not permit the use of full radius elbows.

.2 Provide single thickness turning vanes. Vanes in galvanized sheet metal ducts shall be constructed from galvanized steel, minimum thickness 0.76 mm. Vanes shall be spaced at 40 mm centres and shall turn through 90 deg., with a radius of 50 mm. Vanes shall not include a straight trailing edge. The maximum supported vane length shall be 750 mm. Use multiple single thickness turning vane sections for wider ducts. Install vanes tangent to airflow. Refer to Figs. 2-3 and 2-4 of the SMACNA Duct Construction Standards. Vanes and runners in aluminum ducts shall be constructed from aluminum. Aluminum vanes shall be 0.86 mm thick.

.4 Branches:

.1 Rectangular main and branch: with radius on branch 1.5 times width of duct and 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.

.5 Transitions:

.1 In accordance with Fig. 2-9 of the SMACNA Duct Construction Standards.

.2 Diverging: 20 degrees maximum included angle.

.3 Converging: 30 degrees maximum included angle.

.4 Maximum divergence upstream of equipment to be 30 deg. and 45 deg. Convergence downstream.

.6 Offsets:

.1 Short radius elbows.

.2 Obstruction deflectors: maintain full cross-sectional area.

2.7 Ductwork – Acoustically Lined

.1 Where round ductwork is indicated to be acoustically insulated, it shall consist of two concentric round ducts with 25 mm thick flexible fibrous glass duct liner between the two ducts. The inner duct shall be perforated and correspond to the duct diameter noted on the drawings. The outer duct shall be suitable for the static pressure and shall be sealed airtight where it joins the adjacent ductwork.

2.8 Hangers and Supports

.1 Hangers and Supports: in accordance with Section 23 05 29 - Hangers and Supports for Mechanical Piping and Equipment.

.2 Strap hangers: of same material as duct but next sheet metal thickness heavier than duct.

.1 Maximum size duct supported by strap hanger: 500 mm.

.3 Hanger configuration: to SMACNA.

3. EXECUTION

3.1 Flexible Ductwork - 500 Pa Static Pressure

.1 Installed lengths shall be limited to 6 times duct diameter but not longer than 900 mm. Do not use for changes in direction greater than 60º.

.2 Connect to ductwork and diffusers with stainless steel worm drive clamps or Panduit adjustable clamps or Thermaflex duct strap applied over two wraps of duct tape. Use stainless steel clamps on connections to fire dampers.

.3 Minimum centreline radius of flexible ductwork bends shall be 1.5 times the duct diameter, alternatively, sheet metal elbows may be used at branch takeoffs and boot/diffuser connections. Very sharp turns and reduction in the area of the duct will not be permitted.

.4 Support with 25 mm x 0.76 mm galvanized steel straps at a maximum of 600mm. Straps shall completely encircle duct. Support to prevent sagging of duct.

.5 Support clear of ceiling assembly, light fixtures, and hot surfaces.

.6 Do not use flexible ductwork in secure areas.

3.2 Ductwork Leakage Test

.1 Leakage test all 750 Pa and greater static pressure supply ductwork installed under this contract, as recommended in the SMACNA H.V.A.C. Air Duct Leakage Test Manual to a static pressure 500 Pa in excess of the specified ductwork design static pressure.

.2 Use equipment capable of demonstrating leakage.

.3 Test the first 30 m of installed ductwork in the presence of the Departmental Representative.

.4 Test a representative 30m section of 500 Pa static pressure ductwork, where complete systems over 30m long are installed.

.5 The total allowable leakage for the entire system shall be not greater than 5 percent of the total system capacity.

.6 Submit test reports for all ducts tested.

END OF SECTION

1. GENERAL

1.1 Section Scope

.1 Materials and installation for duct accessories including flexible connections, access doors, and collars.

1.2 Related Requirements

.1 This section of the Specification forms part of the Contract Documents and is to be read, interpreted, and coordinated with all other parts.

.2 Section 21 05 01 – Common Work Results for Mechanical

.3 Section 23 31 00 – HVAC Ducts and Casings

1.3 References

.1 The latest revisions of the following standards shall apply unless noted otherwise.

.1 National Fire Protection Association (NFPA)

.1 NFPA 90A, Standard for the Installation of Air Conditioning and Ventilating Systems.

.2 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA).

.1 SMACNA - HVAC Duct Construction Standards - Metal and Flexible.

1.4 Submittals

.1 Comply with Division 01 – Submittal Procedures and Closeout Procedures, Section 21 05 01 Common Work Results for Mechanical – Submittals and in addition the following:

.1 Submit shop drawings for the following:

.1 Flexible connections

.2 Duct access doors

.3 Instrument test ports

.4 Control dampers

.5 Dryer lint trap

.6 Balancing dampers

.7 Backdraft dampers

.2 Sustainable Design Submittals:

.1 Construction Waste Management:

.1 Submit project Waste Reduction Workplan highlighting recycling and salvage requirements.

.2 Submit calculations on end-of-project recycling rates, salvage rates, and landfill rates demonstrating that 75 % of construction wastes were recycled or salvaged.

2. PRODUCTS

2.1 General

.1 Manufacture in accordance with SMACNA - HVAC Duct Construction Standards.

2.2 Backdraft Dampers – Light Duty

.1 Minimum Requirements:

.1 1.4 mm thick galvanized steel or aluminum channel frame.

.2 0.41 mm thick embossed aluminum blades.

.3 Full blade length shafts, brass bearings.

.4 Felt or neoprene anti-chatter blade strips.

.5 Maximum blade height per section, 610 mm, uses multiple sections for larger dimensions.

.6 Maximum blade length of 460 mm, use multiple sections for larger dimensions.

.7 Manufacturer's label.

.8 Where a balanced backdraft damper (BBD) is indicated, the damper shall incorporate an adjustable counterbalance weight and lever.

.9 Maximum pressure drop across damper at 4.06 m/s shall be 35 Pa.

2.3 Balancing Dampers

.1 Minimum Requirements:

.1 Rectangular ducts:

.1 Up to 300 mm deep - single blade (butterfly type).

.2 330 mm to 400 mm deep - two opposed blades, mechanically interlocked with pivots at quarter points.

.2 Round Ducts:

.1 Single blade (butterfly type).

.3 Material:

.1 Minimum 1.47 mm thick galvanized steel blade on all butterfly dampers.

.2 Minimum 1.47 mm thick galvanized steel blades on multi-blade dampers with rigidly constructed galvanized steel frame (no frame required on single blade dampers).

.4 Bearings:

.1 End bearings on all low pressure single blade dampers above 300 mm dia.

.2 Bearings on multiple blade dampers shall be bronze oilite type.

.5 Operating Mechanism:

.1 Lockable quadrant type with end bearing on accessible rectangular ducts up to 400 mm deep and on accessible round ducts.

.2 Wide pitch screw mechanism type with crank operator on accessible rectangular ducts 430 mm and over in depth and on inaccessible rectangular and round ducts.

.3 Override limiting stops.

.4 No blade movement in set position.

.6 Concealed Regulators:

.1 For all drywall ceilings, which do not have access panels, provide concealed balancing damper regulators embedded in the finished ceiling, mounted behind grilles, on or inside plenum slot diffusers and various types of diffusers. Concealed damper regulator to be connected to balancing damper by means of flexible cable and to be installed flush with ceiling. Cover plate to be held in place with 2 screws and to be easily removed for damper adjustment.

.2 Optional concealed regulator shall be either remotely accessible as coordinated on the drawings, or accessible at the face of the diffuser/grille to meet installation requirements of the concealed regulator.

2.4 Duct and Plenum Access

.1 Locations: Refer to Part 3 (Execution).

.2 Dimensions:

.1 Doors:

.1 500 mm wide x 1370 mm high.

.2 Head of door 1780 mm above floor.

.2 Panels:

.1 380 mm x 500 mm.

.2 Where the far corners of the duct are closer than 500 mm and the equipment within the duct is closer than 300 mm the size may be reduced to 400 mm x 300 mm or 450 mm x 250 mm elliptical.

.3 Where space will not permit the above dimensions to be attained they should be matched as closely as possible and where necessary additional access be provided.

.3 Products:

.1 Doors - construct in accordance with SMACNA Duct Standards. 40 mm thick insulation.

.2 Panels:

.1 Non-Insulated Duct: sandwich construction of same material as duct, one sheet metal thickness heavier, minimum 0.7 mm thick complete with sheet metal angle frame.

.2 Insulated Duct: as above with 25 mm thick insulation.

.3 Gaskets - neoprene or foam rubber.

.4 Hardware:

.1 Panels up to 400 mm x 300 mm - 2 Cam locks complete with safety chain.

.2 Panels - 380 mm x 500 mm - 4 Cam locks complete with safety chain.

.3 Doors - piano hinge and Ventlok 310 latches c/w front and inside handles and front door pull.

2.5 Duct Connectors – Thermal breaks

.1 Provide flexible duct connections to provide thermal breaks in all sheet metal ducts and plenums passing through or terminating at the exterior of the building. Install inside the building.

.2 Minimum Requirements:

.1 Pre-assembled 75 mm long thermal barrier with 75 mm long, 0.61 mm galvanized steel duct connectors on each side of the thermal break.

.2 Thermal break – heavy duty glass fabric with elastomer coating.

2.6 Duct Connectors – Vibration Isolation

.1 Provide flexible duct connections to provide vibration isolation at all duct and plenum connections to fan and air handling units. See Figure 2-19 SMACNA Duct Standards.

.2 Minimum Requirements:

.1 Pre-assembled 75 mm minimum long flexible connection with 75 mm long 0.62 mm galvanized steel duct connectors on each side of the flexible connection. Flexible connector - fiber glass fabric with elastomer coating.

.2 Fire resistant, self extinguishing, neoprene coated glass fabric, temperature rated at minus 40 degrees C to plus 90 degrees C, density of 1.3 kg/m2.

2.7 Dryer Lint Trap – Standard Appliance Type

.1 Lint trap suitable for surface mount or drywall mount

.2 No rough exposed edges

.3 Galvanized steel assembly with cleanable stainless steel mesh screen attached to a clear plexiglass front cover. Cover to pull out for cleaning and held in place by two heavy duty magnets to create an air tight seal.

.4 Lint trap approximately 180mm wide x 150mm long x 180mm high

.5 Inlet collar 100mm diameter.

.6 Outlet collar 125mm diameter

2.8 Dryer Lint Trap – Stacked Washer/Dryer Type

.1 Lint trap suitable for surface mount on stacked washer/dryer application

.2 Galvanized steel assembly with white enamel finish

.3 Cleanable stainless steel mesh screen attached to a pull out tray with clear plexiglass front cover.

.4 Positive lock to create an air tight seal.

.5 Lint trap approximately 200mm wide x 700mm long x 90mm high

.6 Inlet collar 100mm diameter.

.7 Outlet collar 125mm diameter

2.9 Instrument Test Ports

.1 1.35 mm thick steel zinc plated after manufacture.

.2 Cam lock handles with neoprene expansion plug and handle chain.

.3 25 mm minimum inside diameter. Length to suit insulation thickness.

.4 Neoprene mounting gasket.

2.10 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.

2.11 Control Dampers

.1 Unless otherwise specified elsewhere, shall be as follows.

.2 Type: Control dampers shall be the parallel or opposed-blade type as specified below or as scheduled on drawings or as per the following:

.1 Outdoor and return air mixing dampers and face-and-bypass dampers shall be parallel-blade and shall direct airstreams toward each other.

.2 Other modulating dampers shall be opposed-blade.

.3 Two-position shutoff dampers shall be parallel- or opposed-blade with blade and side seals.

.3 Frame: Damper frames shall be 2.38 mm galvanized steel channel or 3.175 mm extruded aluminium with reinforced corner bracing.

.4 Blades: Damper blades shall not exceed 20 cm in width or 125 cm in length. Blades shall be suitable for medium velocity (10 m/s) performance. Blades shall be not less than 1.58 mm.

.5 Shaft Bearings: Damper shaft bearings shall be as recommended by manufacturer for application, oil impregnated sintered bronze, or better.

.6 Seals: Blade edges and frame top and bottom shall have replaceable seals of butyl rubber or neoprene. Side seals shall be spring-loaded stainless steel. Blade seals shall leak no more than 50 L/s·m2 at 1000 Pa differential pressure. Blades shall be air foil type suitable for wide-open face velocity of 7.5 m/s.

.7 Sections: Individual damper sections shall not exceed 125 cm × 150 cm. Each section shall have at least one damper actuator.

.8 Modulating dampers shall provide a linear flow characteristic where possible.

.9 Linkages: Dampers shall have exposed linkages.

.10 Sizing: refer to drawings.

.11 Control dampers subjected to outdoor air conditions, including but not limited to outdoor air intake, exhaust air and relief air dampers shall be provided complete with thermally insulated blades and thermally broken frames, suitable for operation to -40°C.

2.12 Wire Mesh Screens

.1 Provide wire mesh screens in all air intake openings where noted on the drawings.

.2 Screens shall be constructed from aluminum wire 1.3 mm diameter.

.3 Screen mesh shall be 15 mm.

.4 Mount screens in 0.66 mm thick folded aluminum frames.

2.13 Counter Flashings

.1 Counter Flashings – galvanized sheet steel of 0.8 mm minimum thickness.

.2 Counter flashings are attached to mechanical equipment and lap the base flashings on the roof curbs.

.3 All joints in counter flashings shall be flattened and solder double seam. Storm collars shall be adjustable to draw tight to pipe with bolts. Caulk around the top edge. Storm collars shall be used above all roof jacks.

.4 Vertical flange section of roof jacks shall be screwed to face of curb.

3. EXECUTION

3.1 Manufacturer's Instructions

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

3.2 Balancing Dampers

.1 Install in accordance with recommendations of SMACNA and in accordance with manufacturer’s recommendations.

.2 Provide balancing dampers at points on low pressure supply, return and exhaust systems where branches are taken from larger duct as required for proper air balancing.

.3 Provide balancing dampers at each run out to a grille or diffuser. Install damper as close to branch take-off as possible.

.4 Identify the airflow direction and blade rotation and open and closed position.

.5 On all round ductwork larger than 300 mm diameter and on externally insulated rectangular ductwork, provide sheet metal bridge to raise quadrant type operators above the insulation thickness (coordinate with Duct Insulation Section 23 07 13). Provide an open end bearing where bridges are used. Bridges on uninsulated round ducts shall be at least 25 mm high.

.6 Where quadrant type operators are used, the lever shall be arranged parallel with the damper blade.

.7 Where balancing dampers are located above hard-ceilings (e.g. drywall), provide access panels or a remote operating device actuated by a socket or screwdriver.

.8 Coordinate the installation of all dampers with the balancing contractor to ensure all dampers are accessible for system balancing.

3.3 Backdraft Dampers

.1 Install backdraft dampers on all exhaust and relief openings through the building walls and roof on all exhaust fans where control dampers are not called for or indicated.

3.4 Control Dampers – Automatic

.1 Packaged equipment specified to be complete with control dampers, shall include control dampers as normally supplied by the equipment manufacturer unless otherwise noted.

.2 All other automatic control dampers shall be provided and installed under this Section.

.3 Damper submittals shall be coordinated for type, quantity, and size to ensure compatibility with sheet metal design.

.4 Duct openings shall be free of any obstruction or irregularities that might interfere with blade or linkage rotation or actuator mounting. Duct openings shall measure 6 mm larger than damper dimensions and shall be square, straight, and level.

.5 Individual damper sections, as well as entire multiple section assemblies, must be completely square and free from racking, twisting, or bending. Measure diagonally from upper corners to opposite lower corners of each damper section. Both dimensions must be within 3 mm of each other.

.6 Follow the manufacturer's instructions for field installation of control dampers. Unless specifically designed for vertical blade application, dampers must be mounted with blade axis horizontal.

.7 Install extended shaft or jackshaft according to manufacturer’s instructions. (Typically, a sticker on the damper face shows recommended extended shaft location. Attach shaft on labeled side of damper to that blade.)

.8 Damper blades, axles, and linkage must operate without binding. Before system operation, cycle damper after installation to ensure proper operation.

.9 Support ductwork in area of damper when required to prevent sagging due to damper weight.

.10 After installation of low-leakage dampers with seals, caulk between frame and duct or opening to prevent leakage around perimeter of damper.

.11 The indicated size of control dampers is the dimension outside the frame. Oversize the ductwork to include the depth of the damper frame if the pressure drop across the damper exceeds 25 Pa.

.12 Control damper frames shall be fitted tightly into ductwork and sealed airtight.

.13 Check that dampers are installed square and true. Ensure that damper end linkages are easily accessible.

.14 Do not install control dampers within the thickness of any wall unless otherwise indicated.

3.5 Duct and Plenum Access

.1 Locations: Provide access doors and panels as follows:

- .1 Doors: where shown on the drawings.
- .2 Panels:
  - .1 Every 12 m on all ductwork.
  - .2 At the base of each duct riser.
  - .3 Both sides of equipment blocking the duct e.g.
    - .1 Air flow measuring stations
    - .2 Coils
  - .4 At or to one side of other equipment in duct e.g.
    - .1 Backdraft dampers (counter weight side)
    - .2 Balance dampers serving multiple outlets/inlets

.3 Bearings (fans/motors)

.4 Control dampers

.5 Control sensors

.5 Panels need not be provided where access is available through a door or a register mounted on the side of the duct.

.3 Patches:

.1 Where required for cleaning and where access panels are not specified, e.g. on both sides of turning vanes.

.4 Flexible duct - on round duct and round fire dampers up to 300 mm dia.

.2 Seal frames airtight.

.3 Install so as not to interfere with airflow.

.4 Install to provide easiest possible access for service and cleaning.

.5 Do not use sheet metal screws for attaching access panels to ductwork.

.6 Round ducts 330 mm dia. and larger shall include a short collar for the installation of access panels.

.7 Small rectangular ducts shall be transitioned to a minimum dimension across the duct of 330 mm for the installation of access panels.

3.6 Duct Connectors – Vibration Isolation

.1 Install in the 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 Ensure flexible duct connectors do not reduce free area on suction side of fans.

.3 Ducting on sides of flexible connection to be in alignment.

.4 Ensure slack material in flexible connection.

3.7 Ductwork – Flexible

.1 Installed lengths shall be limited to 6 times duct diameter but not longer than 900 mm. Do not use for changes in direction greater than 60º.

.2 Connect to ductwork and diffusers with stainless steel worm drive clamps or Panduit adjustable clamps or Thermaflex duct strap applied over two wraps of duct tape. Use stainless steel clamps on connections to fire dampers.

.3 Minimum centreline radius of flexible ductwork bends shall be 1.5 times the duct diameter, alternatively, sheet metal elbows may be used at branch takeoffs and boot/diffuser connections. Very sharp turns and reduction in the area of the duct will not be permitted.

.4 Support with 25 mm x 0.76 mm galvanized steel straps at a maximum of 600mm. Straps shall completely encircle duct. Support to prevent sagging of duct.

.5 Support clear of ceiling assembly, light fixtures, and hot surfaces.

3.8 Dryer Lint Trap – Stacked Washer/Dryer Type

.1 Clean the dryer top surface properly before installation.

.2 Mark Lint Trap position on the dryer, the lint trap inlet collar, and the dryer exhaust must be aligned.

.3 Fix double sided foam tape on the bottom surface of the lint trap, tape spacing equally before fixing into place.

.4 Connect inlet and outlet ducts as indicated. Always use rigid duct at inlet and outlet connections.

3.9 Instrument Test Ports

.1 Locate to permit easy manipulation of instruments.

.2 Install insulation port extensions as required.

.3 Locations:

- .1 For traverse readings:
  - .1 Ducted inlets to roof and wall exhausters.
  - .2 Inlets and outlets of other fan systems.
  - .3 Main and sub-main ducts.
  - .4 As indicated.
- .2 For temperature readings:
  - .1 At outside air intakes.
  - .2 In mixed air applications in locations as approved by the Departmental Representative.
  - .3 At inlet and outlet of coils.
  - .4 Downstream of junction of two converging air streams of different temperatures.
  - .5 As indicated.
- .3 In addition to the locations specified, install instrument test ports in ductwork as directed by the Testing and Balancing Contractor. Test port covers are to be installed after the balancing is complete, however insure the insulation is repaired at test port locations. Install heavy duty locking quadrant handles at all balancing dampers (except splitter dampers). Ensure handles are marked in the final set position by the Testing and Balancing Contractor.

END OF SECTION

1. GENERAL

1.1 Summary

.1 Section Includes:

.1 Fans, motors, accessories, and hardware for commercial use.

.2 Sustainable requirements for construction and verification.

.2 Related Sections:

.1 Section 21 05 01 Common Work Results for Mechanical.

.2 Section 23 05 48 Vibration and Seismic Control for Mechanical.

.3 Section 23 33 00 Duct Accessories.

1.2 References

.1 Air Movement and Control Association International, Inc. (AMCA)

.1 AMCA Publication 99, Standards Handbook.

.2 AMCA 300, Reverberant Room Method for Sound Testing of Fans.

.3 AMCA 301, Methods for Calculating Fan Sound Ratings from Laboratory Test Data.

.2 American National Standards Institute (ANSI)/American Society of Mechanical Engineers (ASME)

.1 ANSI/AMCA 210, Laboratory Methods of Testing Fans for Aerodynamic Performance Rating.

.3 Canadian General Standards Board (CGSB)

.1 CAN/CGSB 1.181, Ready-Mixed Organic Zinc-Rich Coating.

.4 Health Canada/Workplace Hazardous Materials Information System (WHMIS)

.1 Material Safety Data Sheets (MSDS).

1.3 System Description

.1 Performance Requirements:

.1 Catalogued or published ratings for manufactured items: obtained from tests carried out by manufacturer or those ordered by manufacturer from independent testing agency signifying adherence to codes and standards in force.

.2 Capacity: flow rate, static pressure, bhp, efficiency, revolutions per minute, power, model, size, sound power data and as indicated on schedule.

.3 Fans: statically and dynamically balanced, constructed in conformity with AMCA 99.

.4 Sound ratings: comply with AMCA 301, tested to AMCA 300. Supply unit with AMCA certified sound rating seal.

.5 Performance ratings: based on tests performed in accordance with ANSI/AMCA 210. Supply unit with AMCA certified rating seal, except for propeller fans smaller than 300 mm diameter.

1.4 Submittals

.1 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.

.2 Shop Drawings:

.1 Submit shop drawings and product data in accordance with Section 01 33 00 - Submittal Procedures.

.3 Provide:

.1 Fan performance curves showing point of operation, BHP, and efficiency.

.2 Sound rating data at point of operation.

.4 Indicate:

.1 Motors, sheaves, bearings, shaft details.

.2 Minimum performance achievable with variable speed controllers and variable inlet vanes as appropriate.

.5 Quality assurance submittals: submit following in accordance with Section 01 33 00 - Submittal Procedures.

.1 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.6 Closeout Submittals:

.1 Provide operation and maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

1.5 Quality Assurance

.1 Health and Safety Requirements: do construction occupational health and safety in accordance with Section 01 35 33 - Health and Safety.

1.6 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, include:

.1 Bearings and seals.

.2 Addresses of suppliers.

.3 List of specialized tools necessary for adjusting, repairing, or replacing.

1.7 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 Waste Management and Disposal: separate waste materials for reuse and recycling in accordance with Section 01 74 21 – Construction Demolition Waste Management and Disposal.

2. PRODUCTS

2.1 Fans General

.1 Motors:

.1 In accordance with Section 21 05 01 - Common Work Results for Mechanical supplemented as specified herein.

.2 Sizes as indicated.

.2 Accessories and hardware: fan inlet safety screens, solid state speed controller as indicated and as specified in Section 21 05 01 - Common Work Results for Mechanical.

.3 Factory primed before assembly in colour standard to manufacturer.

.4 Bearing lubrication systems plus extension lubrication tubes where bearings are not easily accessible.

.5 Vibration isolation: to Section 23 05 48 - Vibration and Seismic Control for Mechanical.

.6 Flexible connections: to Section 23 33 00 - Duct Accessories.

2.2 Cabinet Fans - General Purpose

.1 Fan characteristics and construction: as centrifugal fans.

.2 Cabinet hung single or multiple wheel with DWDI centrifugal fans in factory fabricated casing complete with vibration isolators, motor.

.3 Fabricate casing of zinc coated or phosphate treated steel reinforced and braced for rigidity. Provide removable panels for access to interior. Paint uncoated, steel parts with corrosion resistant paint to CAN/CGSB 1.181. Finish inside and out, over prime coat, with rust resistant enamel. Internally line cabinet with 50 mm thick rigid acoustic insulation.

2.3 Ceiling Exhaust Fans

.1 Centrifugal blower, motor vibration isolated.

.2 Built-in backdraft damper.

.3 White plastic exhaust grille.

.4 Adjustable hanger bracket.

.5 Pre-wired outlet box, plug-in receptacle.

.6 Refer to drawing schedule for further requirements.

.7 Accessories:

.1 Solid state speed control - where scheduled

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 Fan Installation

.1 Install fans as indicated, complete with vibration isolators and seismic restrains as specified in Section 23 05 48 - Vibration and Seismic Control for Mechanical, flexible electrical leads and flexible connections in accordance with Section 23 33 00 - Duct Accessories.

.2 Install fans with flexible connections on inlet ductwork and on discharge ductwork. Ensure metal bands of connectors are parallel with minimum 25 mm flex between ductwork and fan during running.

.3 Install connectors such that connectors are clear of the air stream. Provide flange extensions as necessary. Ensure accurate alignment of duct to fan.

.4 Provide safety screens where fan inlet or outlet is exposed.

.5 Access doors and access panels to be easily accessible.

END OF SECTION

1. GENERAL

1.1 Section Scope

.1 Supply, return, and exhaust grilles, registers, diffusers, and louvres for residential use.

1.2 Related Requirements

.1 This section of the Specification forms part of the Contract Documents and is to be read, interpreted, and coordinated with all other parts.

.2 Section 21 05 01 – Common Work Results for Mechanical

1.3 References

.1 The latest revisions of the following standards shall apply unless noted otherwise.

.1 Applicable Building Code - Refer to Section 21 05 01

.2 American Society for Testing and Materials (ASTM):

.1 ASTM B209-14, Standard Specification for Aluminum and Aluminum Alloy Sheet and Plate

.2 ASTM B211/B211M-19, Standard Specification for Aluminum and Aluminum Alloy Rolled or Cold Finished Bar, Rod, and Wire

.3 ASTM B221-14, Standard Specification for Aluminum and Aluminum Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes

.4 ASTM E90-09(2016), Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements

.3 Canadian Standards Association (CSA):

.1 CAN/CSA-S157-05/S157.1-05 (R2015), Strength Design in Aluminum / Commentary on CSA S157-05, Strength Design in Aluminum

.2 CAN/CSA-S136-16, North American Specification for the Design of Cold-Formed Steel Structural Members

.4 Air Movement and Control Association International Inc. (AMCA):

.1 AMCA Standard 500-L-12 (R2015), Laboratory Methods of Testing Louvers for Rating

.2 AMCA Publication 501-17, Louver Application Manual and Design Guide

.3 AMCA Publication 511-10 (Rev. 12/15), Certified Ratings Program - Product Rating Manual for Air Control Devices

.5 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA).

1.4 Submittals

.1 Comply with Division 01 – Submittal Procedures and Closeout Procedures, Section 21 05 01 Common Work Results for Mechanical – Submittals and in addition the following:

.1 For all grilles, diffusers and louvres provide manufacturer's printed product literature; specifications and datasheet include product characteristics, performance criteria, and limitations.

.2 Indicate following:

.1 Capacity.

.2 Throw and terminal velocity.

.3 Noise criteria.

.4 Pressure drop.

.5 Neck velocity.

.6 Material types and thickness.

.7 Finishes

.8 For louvers, AMCA Certified Air Flow, Water Penetration, and Wind Driven Rain performance test results.

.3 Closeout submittals: submit all reviewed shop drawings for incorporation into manual specified in Section 21 05 01 – Common Work Results - Mechanical

1.5 Quality Assurance

.1 Air flow tests and sound level measurement shall be made in accordance with applicable ADC equipment test codes, ASHRAE Standards and AMCA Standards.

.2 Unit rating shall be approved by ADC and AMCA.

.3 Manufacturer shall certify catalogued performance and ensure correct application of air outlet types.

.4 Outside louvres shall bear AMCA seal for free area and water penetration.

1.6 Delivery, Storage and Handling

.1 Delivery: At the time of delivery, visually inspect all materials for damage. Note any damaged boxes, crates, diffusers, grilles or louver sections on the receiving ticket and immediately report to the shipping company and the material manufacturer.

.2 Storage: Store products raised off the ground and cover with a weather proof flame resistant sheeting or tarpaulin.

.3 Handling:

.1 Material shall be handled in accordance with sound material handling practices and in such a way as to minimize racking.

.2 Louver sections may be hoisted by attaching straps to the jambs and lifting the section while it is in a vertical position.

.3 Louver sections should only be lifted and carried by the jambs. Heads, sills and blades are not to be used for lifting or hoisting louver sections.

1.7 Project Conditions

.1 Review requirements of outlets as to size, finish, and type of mounting prior to submitting shop drawings and schedules of outlets.

.2 Positions indicated are approximate only. Check locations of outlets and make necessary adjustments in position to conform to Architectural features, symmetry, and lighting arrangement.

.3 Review exterior wall details and structural requirements/drawings. Ensure exterior louvre installation is fully coordinated with all other building elements.

1.8 Maintenance

.1 Provide keys for volume control adjustment and/or keys for air flow pattern adjustment as applicable.

2. PRODUCTS

2.1 General

.1 Base air outlet application on space noise level of NC 20 maximum.

.2 Provide anti-smudge frames or plaques on diffusers located in rough textured surfaces such as acoustical plaster.

.3 Provide margin frame with concealed fastening as needed.

.4 Provide grilles with integral, gang-operated dampers with operator, operable from face where duct branch dampers cannot be installed.

.5 Finish in factory color chosen by Departmental Representative or as indicated on drawing schedule.

.6 Refer to schedule on drawings for capacities.

2.2 Supply Air Registers

.1 Supply Register “S-1” and “S-2”:

.1 Industrial strength polymer resin supply register.

.2 Color chosen by Departmental Representative or as per drawing schedule.

.3 Integral volume damper, operable from the grille face.

.4 Integral border, floor, ceiling or wall mount with concealed fastening.

.5 Refer to the drawing schedule for further information and plans for sizes and airflows.

2.3 Return Air Grilles

.1 Return Grille “R-1”:

.1 High strength polymer resin.

.2 Fixed 45° deflection contoured blade parallel with the long dimension

.3 Drywall mount: border for surface mount with counter sunk screw fastening.

.4 The finish shall be snow white or as per drawing schedule.

.5 Approximately 10 mm thick for sidewall flush mount applications and approximately 20 mm thick for baseboard applications.

.6 Refer to the drawing schedule for further information.

.2 Return Grille “R-2”:

.1 High strength polymer resin.

.2 Fixed 45° deflection contoured blade parallel with the long dimension

.3 Drywall mount: border for surface mount with counter sunk screw fastening.

.4 The finish shall be snow white or as per drawing schedule.

.5 Approximately 10 mm thick for sidewall flush mount applications and approximately 20 mm thick for baseboard applications.

.6 Refer to the drawing schedule for further information.

2.4 Wall Caps

.1 0.64 mm aluminum natural finish wall cap.

.2 Built in spring loaded backdraft damper for exhaust applications only

.3 Built in spring loaded backdraft damper without bird screen for dryer venting

.4 Bird screen without backdraft damper for supply applications

.5 Refer to drawings and schedules for size and capacities.

2.5 Fixed Louvres

.1 Drainable louver with concealed vertical mullions

.2 Louvers shall be 102 mm deep

.3 Material: minimum 0.8 mm galvanized steel blades, 1.3 mm galvanized steel frame

.4 Blade: Stormproof pattern, stationary with centre watershed in blade, reinforcing bosses and maximum blade length of 1500 mm.

.5 Percent Free Area: minimum 50%

.6 Beginning point of Water Penetration: 6.35 m/s

.7 Screen: 1.3mm diameter aluminum wire bird screen with 12 mm mesh on inside face of louvres in formed U-frame.

.8 Finish: Factory applied baked enamel finish to Departmental Representative's colour choice, unless specifically noted otherwise in the equipment schedule.

3. EXECUTION

3.1 Examination

.1 Verify that conditions are suitable for installation.

.2 Louvers:

.1 Examine openings to receive work and surrounding adjacent surfaces for conditions affecting installation. Coordinate with related sections providing openings to ensure proper dimensions are maintained.

.2 Verify dimensions of supporting structure by accurate field measurements so that work will be accurately designed, fabricated and fitted to the structure.

.3 Notify Departmental Representative in writing of any conditions that are not acceptable.

.4 Proceed with installation after verification and correction of surface conditions acceptable to manufacturer.

3.2 Priming

.1 Paint ductwork visible behind air outlets matte black.

3.3 Sizing

.1 Size outside air louvres as indicated on drawings.

.2 Size air outlets as indicated on drawings.

3.4 Air Terminals

.1 Install with cadmium plated screws in countersunk holes where fastenings are visible.

.2 Install ductwork as high as practical, using offsets where required to obtain maximum duct neck lengths for diffusers.

.3 Refer to Architectural Reflected Ceiling plans for exact locations of air terminals.

.4 Attach registers and grilles to branch ducts with duct necks having minimum length to prevent grille or register damper from protruding into branch duct.

3.5 Louvres

.1 Install in accordance with manufacturer's and SMACNA recommendations.

.2 Provide all necessary fastenings, anchors, clip angles, sills, flashing and counterflashing for louvres installed in walls required to complete the installation.

.3 Reinforce and brace as required.

.4 Anchor securely to the building substructure. Caulk louvre, flashing, and counterflashing to make installation watertight.

.5 Cut and trim component parts during erection only with the approval of the manufacturer, and in accordance with the manufacturer' recommendations. Restore finish completely.

.6 Remove and replace members where cutting and trimming has impaired the strength or appearance of the assembly.

.7 Set units level, plumb and true to line, with uniform, tight joints to adjacent work.

.8 Blank-off panels shall be constructed to SMACNA standards, minimum 0.8 mm. Sandwich panel with 25 mm thick fibreglass insulation.

.9 All blank-off panels shall have a painted flat black enamel finish.

3.6 Protection

.1 Protect installed materials to prevent damage by other trades. Use materials that may be easily removed without leaving residue or permanent stains.

3.7 Cleaning

.1 Progress Cleaning: Leave work area clean at the end of each work day, ensuring safe movement of passing pedestrians.

.2 Final Cleaning: At completion of installation, clean all surfaces so they are free of foreign matter using cleaners recommended by material manufacturer.

.3 Restore louvers and accessory components damaged during installation and construction so no evidence remains of corrective work. If results of restoration are unsuccessful, as determined by the Departmental Representative, remove and replace damaged systems with new at no additional cost to the Departmental Representative.

.4 Waste Management: Co-ordinate recycling of waste materials and packaging at appropriate facility, diverting waste from landfill. Certified installer shall be responsible for ensuring waste management efforts are practiced.

END OF SECTION

1. GENERAL

1.1 Section Scope

.1 Section Includes:

.1 Materials, components, and installation for heat reclaim devices.

1.2 Related Requirements

.1 This section of the Specification forms part of the Contract Documents and is to be read, interpreted, and coordinated with all other parts.

.2 Section 01 33 00 Submittal Procedures.

.3 Section 01 78 00 Closeout Submittals.

.4 Section 21 05 01 Common Work Results for Mechanical

.5 Section 23 33 00 Duct Accessories.

1.3 References

.1 The latest revisions of the following standards shall apply unless noted otherwise.

.1 Applicable Building Code - Refer to Section 21 05 01.

.2 Air Movement and Control Association (AMCA)

.1 AMCA 210, Laboratory Method of Testing Fans for Aerodynamic Performance Rating (ASHRAE).

.3 American Society of Heating, Refrigeration and Air-Conditioning Engineers (ASHRAE)

.1 ANSI/ASHARE Standard 62.1 - Ventilation for Acceptable Indoor Air Quality.

.2 ANSI/ASHRAE 84, Method of Testing Air-to-Air Heat/Energy Exchangers.

.3 ANSI/ASHARE Standard 90.1 - Energy Standard for Buildings Except Low-Rise Residential Buildings.

.4 American National Standards Institute/Air-Conditioning, Heating and Refrigeration Institute (ANSI/AHRI)

.1 ANSI/AHRI Standard 260 - Sound rating of Ducted Air Moving and Conditioning Equipment.

.2 ANSI/AHRI Standard 1060 – Performance Rating of Air-to-Air Heat exchangers for Energy Recovery Ventilation Equipment.

.5 Canadian Electrical Code C22.2 No. 13-15 – Fans and Ventilators.

.6 Canadian General Standards Board (CGSB)

.1 CAN/CGSB 1.181, Ready-Mixed Organic Zinc-Rich Coating.

.7 NFPA 90A - Standard for the Installation of Air Conditioning and Ventilation Systems.

.8 Underwriter’s laboratory (UL) 1812 - Standard for Ducted Heat Recovery Ventilators.

1.4 Submittals

.1 Comply with Division 01 – Submittal Procedures and Closeout Procedures, Section 21 05 01 Common Work Results for Mechanical – Submittals.

.2 Manufacturer shall submit a copy of the installation instruction to the contractor. Include a copy in the O&M manual.

.3 Manufacturer shall provide the following information with each shop drawing/product data submission:

.1 Each component of the unit shall be identified and mechanical specifications shall be provided for unit and accessories describing construction, components, and options.

.2 Construction Details for the following components:

.1 Side panels, including connection details.

.2 Top panel, including connection details.

.3 Floor, including connection details.

.4 Doors, hinges, latch, viewing port.

.5 Fan, motor and drive, mounting and isolation.

.6 Pipe and conduit penetration through casing or floor.

.7 Drain pan.

.8 Damper, linkage and drive construction and mounting.

.3 Materials of construction: Indicate material and gauge of all construction components.

.4 All performance data, including, as a minimum, the following:

.1 Energy recovery performances

.2 Fan performances

.5 Fan curves shall be provided for fans with the design operating points indicated. Data shall be corrected to actual operating conditions, temperatures, and altitudes.

.6 Filter data shall be provided including media type, efficiency rating, velocity, pressure drop, mounting method and arrangement.

.7 Vibration isolation shop drawings

.8 Wiring diagrams showing factory installed wiring

.9 A schedule detailing necessary trap height shall be provided for each unit. Schedule shall detail unit tag, unit size, appropriate trap schematic with recommended trap dimensions. Contractor shall be responsible for additional trap height required for trapping and insulation.

.10 Sound data shall be provided using AHRI 260 test methods. Unit discharge, inlet, and radiated sound power levels in dB shall be provided for 63, 125, 250, 500, 1000, 2000, 4000 and 8000Hz.

1.5 Quality Assurance

.1 Submit following in accordance with Section 01 33 00 - Submittal Procedures.

.1 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.2 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.

.3 Instructions: submit manufacturer's installation instructions.

1.6 Delivery, Storage and Handling

.1 Comply with manufacturer's installation instructions for rigging, unloading, and transporting units.

.2 Units shall ship fully assembled up to practical shipping and rigging limitations. Units not shipped fully assembled shall have tags and airflow arrows on each section to indicate location and orientation in direction of airflow. Shipping splits shall be clearly defined on submittal drawings. Cost associated with non-conformance to shop drawings shall be the responsibility of the manufacturer. Each section shall have lifting lugs and shipping skid for lifting and forklift transport to allow for field rigging and final placement of section.

.3 Deliver units to jobsite with fan motor(s), sheave(s), and belt(s) as applicable completely assembled and mounted in units.

.4 Unit shall be shipped in a clear shrink-wrap or stretch-wrap to protect unit from in-transit rain and debris per ASHRAE 62.1 recommendations.

.5 Installing contractor shall be responsible for storing units in a clean, dry place and protect from weather and construction traffic. Handle carefully to avoid damage to components, enclosures, and finish.

1.7 Maintenance

.1 Extra Materials

.1 Provide maintenance materials in accordance with Section 01 78 00 Closeout Submittals.

.2 Provide 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.

2. PRODUCTS

2.1 Heat Recovery Unit

.1 Minimum Requirements:

.1 0.91 mm galvanized steel casing with enamel finish.

.2 25 mm rigid foil-faced fiberglass or molded EPS insulation.

.3 Continuous molded ABS drain pans on both exhaust and supply sides.

.4 High efficiency, direct drive, double inlet centrifugal fans.

.5 Electronically and independently adjustable supply and exhaust fan motors with sealed ball bearings, polyurethane paint and stainless steel shafts, non-dust-loading backward-inclined impellers.

.6 Electrical requirement: 115 VAC complete with 1219mm cord set with ground.

.7 Ability to provide an on-demand boost for maximum ventilation.

.8 Removable high-efficiency polypropylene heat recovery core.

.9 Standard low voltage control circuit to permit connection of dehumidistat, switches or timers.

.10 Motorized supply air damper and gravity exhaust air damper.

.11 Twist-in collars for easy flex-duct attachment.

.12 Factory vibration-isolating springs.

.13 Gauge ports on the door for fast and reliable airflow readings.

.14 Automatic timed recirculation defrost control using only the four duct connections. A fifth duct connection shall not be required. Defrost cycles controlled by a temperature sensor when outdoor temperature drops below -5°C.

.15 Lifetime warranty on the heat recovery core and minimum 5 year warranty on the overall unit.

.16 Refer also to the drawing schedule for further information.

.17 The design is based on equipment indicated on the drawing schedule. Refer to Section 21 05 01 Common Work Results for Mechanical, Alternate Materials and Equipment for requirements associated with equal or alternate equipment.

.18 Include the following accessories:

.1 Enhanced digital multifunction wall control with LCD display with backlight. Automatic and programmable control. Manual high and low-speed air exchange Dynamic exchange and recirculation indicators, indoor temperature and relative humidity display, eco and high occupancy modes. Maintenance indicator.

.2 MERV 6 washable supply air filter.

3. EXECUTION

3.1 Manufacturer’s Instructions

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

3.2 Heat Recovery Ventilators Installation

.1 Install in accordance with manufacturer’s recommendations.

.2 Support independently of adjacent ductwork. Install flexible connections at unit inlet and outlets.

.3 Ensure adequate clearance for servicing and maintenance.

.4 The Mechanical Contractor shall be responsible to coordinate ALL of his installation requirements with the Departmental Representative and the General Contractor to ensure that a complete installation for each unit is being provided. Coordination efforts shall include such items as unloading and hoisting requirements, field wiring requirements, field piping requirements, field ductwork requirements, requirements for assembly of field-bolted or welded joints, and all other installation and assembly requirements.

.5 Where applicable the manufacturer shall provide all screws and gaskets for joining of sections in the field.

.6 Where applicable, install fan sheaves required for final air balance.

.7 Do not operate units for any purpose, temporary or permanent, until ductwork is clean, filters are in place, bearings lubricated, and fan has been test run under observation.

.8 Start-up Heat Recovery Ventilators in accordance with manufacturer’s start-up instructions. Provide start-up report to the Departmental Representative, and include in O & M manual.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 This Section describes the Common Work Results applicable to electrical disciplines.

1.2 DEFINITIONS

.1 Electrical and electronic terms: unless otherwise specified or indicated, terms used in these specifications, and on drawings, are those defined by IEEE SP1122.

1.3 GENERAL

.1 The general conditions and general requirements together with all amendments and supplements contained in the General Specifications shall form an integral part of the electrical specification and will be made part of this contract.

.2 Reference to “Electrical Divisions” shall mean all Divisions 26, 27, 28, 33 and 48 in the Master Format or the Canadian Master Specifications.

.3 The words "Provide" or “Furnish” shall mean "Supply and Install" the products and services specified. "As Indicated" means that the item(s) specified are shown on the drawings.

.4 Confirm with the architectural plans and specifications the extent and nature of the work and how it will affect the electrical work. Include in the Tender/RFP sum for any complications or additional work described therein.

.5 Review mechanical plans and specifications for the extent of electrical work required to make mechanical systems complete and include this work in the Tender/RFP sum.

.6 Review structural plans for limitations of penetrations or inclusions of electrical equipment. In the Tender/RFP sum, allow for avoiding critical areas with electrical equipment.

.7 Review existing record plans and site conditions for limitations of penetrations or inclusions of electrical equipment. In Tender/RFP sum, allow for avoiding critical areas with electrical equipment.

.8 Comply with the requirements of the General Contract and coordinate the installation with all other trades on site.

.9 Confirm on-site the exact location of equipment, outlets, and fixtures and the location of outlets for equipment supplied by other trades.

1.4 ELECTRICAL SCOPE OF WORK

.1 The electrical scope of work shall include the supply and installation of all the necessary materials and apparatus for complete operating systems as indicated on the plans or mentioned in this specification, with the exception of materials or apparatus specifically mentioned to be omitted or to be supplied by Departmental Representative.

.2 Items obviously necessary or reasonably implied to complete the work shall be included as if shown on drawings and noted in the specifications.

.3 All materials, tools, appliances, scaffolding, apparatus and labour necessary for the execution, erection and completion of the systems described herein shall be furnished. This includes providing temporary lighting and power for own work.

.4 This contract shall include, but is not confined to, the following scope of work:

.1 Main power service

.2 Power distribution equipment

.3 Power connections and outlets

.4 Mechanical equipment connections

.5 Lighting system

.6 Lighting controls system

.7 Smoke alarm/carbon monoxide detector system

.8 Tel/Data/Communications system

.9 Cable TV

.5 Complete all electrical connections to equipment and accessories pertaining to this contract and leave all in operating condition to the Departmental Representative's satisfaction.

.6 Remove all existing electrical equipment and material made redundant by this contract or in conflict with work to be carried out. Reroute, reinstall or replace existing electrical material that becomes necessary due to work carried out by this contract so a complete working electrical system will be retained in all areas affected by this installation.

1.5 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section [01 33 00- Submittal Procedures] .

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for lighting, outlets, panelboards, etc.

.3 Shop drawings:

.1 Submit drawings stamped and signed by professional engineer registered or licensed in British Columbia, Canada.

.2 Submit wiring diagrams and installation details of equipment indicating proposed location, layout and arrangement, control panels, accessories, piping, ductwork, and other items that must be shown to ensure co-ordinated installation.

.3 Identify on wiring diagrams circuit terminals and indicate internal wiring for each item of equipment and interconnection between each item of equipment.

.4 Indicate of drawings clearances for operation, maintenance, and replacement of operating equipment devices.

.5 If changes are required, notify Departmental Representative of these changes before they are made.

.4 Certificates:

.1 Provide CSA certified equipment.

.2 Where CSA certified equipment is not available, submit such equipment to inspection authorities 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.

.5 Submit certificate of acceptance from authority having jurisdiction upon completion of Work to Departmental Representative.

1.6 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00- Closeout Submittals.

1.7 DELIVERY, STORAGE AND HANDLING

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

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

.3 Storage and Handling Requirements:

.1 Store materials indoors and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

Part 2 Products

2.1 DESIGN REQUIREMENTS

.1 Operating voltages: to CAN3-C235.

.2 Motors, electric heating, control and distribution devices and equipment to operate satisfactorily at 60 Hz within normal operating limits established by above standard.

.1 Equipment to operate in extreme operating conditions established in above standard without damage to equipment.

.3 Language operating requirements: provide identification labels for control items in English and French.

.4 Use one label for each language.

2.2 MATERIALS AND EQUIPMENT

.1 Provide material and equipment in accordance with Section 01 61 00- Common Product Requirements.

.2 Equipment and material to be CSA certified. Where CSA certified equipment and materials are not available, obtain special approval from inspection authorities before delivery to site and submit such approval as described in PART 1 - ACTION AND INFORMATIONAL SUBMITTALS.

.3 Factory assemble control panels and component assemblies.

2.3 WARNING SIGNS

.1 Warning Signs: in accordance with requirements of authority having jurisdiction and Departmental Representative.

.2 Decal signs, minimum size 175 x 250 mm.

2.4 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 labels as follows:

.2 Labels: embossed plastic labels with [6] mm high letters unless specified otherwise.

.3 Wording on to be approved by Departmental Representative prior to manufacture.

.4 Allow for minimum of twenty-five (25) letters per label.

.5 Nameplates for terminal cabinets and junction boxes to indicate system and/or voltage characteristics.

.6 Disconnects, starters and contactors: indicate equipment being controlled and voltage.

.7 Terminal cabinets and pull boxes: indicate system and voltage.

.8 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 [20] mm wide auxiliary colour.

Type	Prime	Auxiliary
up to 250 V	Yellow	
up to 600 V	Yellow	Green
up to 5 kV	Yellow	Blue
up to 15 kV	Yellow	Red
Telephone	Green	
Other Communication Systems	Green	Blue
Fire Alarm	Red	
Emergency Voice	Red	Blue
Other Security Systems	Red	Yellow

2.8 FINISHES

.1 Shop finish metal enclosure surfaces by application of rust resistant primer inside and outside, and at least two coats of finish enamel.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable.

.1 Visually inspect substrate in presence of Departmental Representative.

.2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 INSTALLATION

.1 Do complete installation in accordance with CSA C22.1 except where specified otherwise.

.2 Do overhead and underground systems in accordance with CAN/CSA-C22.3 No.1 except where specified otherwise.

3.3 NAMEPLATES AND LABELS

.1 Ensure manufacturer's nameplates, CSA labels and identification nameplates are visible and legible after equipment is installed.

3.4 LOCATION OF OUTLETS

.1 Do not install outlets back-to-back in wall; allow minimum 150 mm horizontal clearance between boxes.

.2 Change location of outlets at no extra cost or credit, providing distance does not exceed 3000 mm, and information is given before installation.

.3 Locate light switches on latch side of doors.

.1 Locate disconnect devices in mechanical and elevator machine rooms on latch side of floor.

3.5 MOUNTING HEIGHTS

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

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

.3 Install electrical equipment at following heights unless indicated otherwise.

.1 Local switches: [1200] mm.

.2 Wall receptacles:

.1 General: 400 mm.

.2 Above top of counters or counter splash backs: 175 mm.

.3 Panelboards: as required by Code or as indicated.

.4 Telephone and interphone outlets: 400 mm.

.5 Television outlets: [400] mm.

3.6 CO-ORDINATION OF PROTECTIVE DEVICES

.1 Ensure circuit protective devices such as overcurrent trips, relays and fuses are installed to required values and settings.

3.7 FIELD QUALITY CONTROL

.1 Load Balance:

.1 Measure phase current to panelboards with normal loads (lighting) operating at time of acceptance; adjust branch circuit connections as required to obtain best balance of current between phases and record changes.

.2 Provide upon completion of work, load balance report as directed in PART 1 - ACTION AND INFORMATIONAL SUBMITTALS, phase and neutral currents on panelboards, dry-core transformers and motor control centres, operating under normal load, as well as hour and date on which each load was measured, and voltage at time of test.

.2 Conduct following tests in accordance with Section [01 45 00- Quality Control] .

.1 Power distribution system including phasing, voltage, grounding and load balancing.

.2 Circuits originating from branch distribution panels.

.3 Lighting and its control.

.4 Motors, heaters and associated control equipment including sequenced operation of systems where applicable.

.5 Insulation resistance testing:

.1 Megger circuits, feeders and equipment up to 350 V with a 500 V instrument.

.2 Megger 350-600 V circuits, feeders and equipment with a 1000 V instrument.

.3 Check resistance to ground before energizing.

.3 Notifiy Departmental representative 2 weeks prior to testing and carry out tests in presence of Departmental Representative if required.

.4 Provide instruments, meters, equipment and personnel required to conduct tests during and at conclusion of project.

.5 Manufacturer's Field Services:

.1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit

Manufacturer's Field Reports as described in PART 1 - ACTION AND INFORMATIONAL SUBMITTALS.

.2 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.

3.8 SYSTEM STARTUP

.1 Instruct Departmental Representative in operation, care and maintenance of systems, system equipment and components.

.2 Arrange and pay for services of manufacturer's factory service engineer to supervise start-up of installation, check, adjust, balance and calibrate components and instruct operating personnel.

.3 Provide these services for such period, and for as many visits as necessary to put equipment in operation, and ensure that operating personnel are conversant with aspects of its care and operation.

3.9 CLEANING

.1 Progress Cleaning: clean in accordance with Section [01 74 11- Cleaning] .

.1 Leave Work area clean at end of each day.

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

.3 Waste Management: separate waste materials for recycling/reuse in accordance with Section 01 74 19- Waste Management and Disposal.

.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 This Section includes requirements for selective demolition and removal of electrical components including removal of conduit, wiring, junction boxes, and panels to source and incidentals required to complete work described in this Section ready for new construction.

1.2 REFERENCE STANDARDS

.1 Canadian Standards Association (CSA)

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

1.3 DEFINITIONS

.1 Demolish: Detach items from existing construction and legally dispose of items off site, unless indicated as removed and salvaged, or removed and reinstalled.

.2 Remove: Planned deconstruction and disassembly of electrical items from existing construction including removal of conduit, junction boxes , cabling and wiring from electrical component to panel taking care not to damage adjacent assemblies designated to remain; legally dispose of items off site, unless indicated as removed and salvaged, or removed and reinstalled.

.3 Remove and Salvage: Detach items from existing construction and deliver them to Departmental Representative ready for reuse.

.4 Remove and Reinstall: Detach items from existing construction, prepare them for reuse, and reinstall them where indicated. Extend wiring as required to allow for reinstallation.

.5 Remove and relocate: Detach items from existing construction, prepare them for reuse, and reinstall them where indicated. Extend wiring as required to all for reinstallation.

.6 Relocate and replace with new. Detach items from existing construction, extend wiring as required to new location and install new item in new location. Use existing circuit and extended wiring for reinstall.

.7 Existing to Remain: Existing items of construction that are not removed and that are not otherwise indicated as being removed and salvaged, or removed and reinstalled.

.8 Hazardous Substances: Dangerous substances, dangerous goods, hazardous commodities and hazardous products may include asbestos, mercury and lead, PCB's, poisons, corrosive agents, flammable substances, radioactive substances, or other material that can endanger human health or wellbeing or environment if handled improperly as defined by Federal Hazardous Products Act (RSC 1985) including latest amendments.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

.1 Action Submittals: Provide in accordance with Section 01 33 00– Submittal Procedures before starting work of this Section:

.1 Construction Waste Management Plan (CWM Plan): Submit plan addressing opportunities for reduction, reuse, or recycling of materials prepared in accordance with Section 01 74 19– Construction Waste Management and Disposal.

.2 Landfill Records: Indicate receipt and acceptance of selective demolition waste and hazardous wastes by a landfill facility licensed to accept hazardous wastes.

1.5 ADMINISTRATIVE REQUIREMENTS

.1 Coordination: Coordinate work of this Section to avoid interference with work by other Sections.

1.6 QUALITY ASSURANCE

.1 Regulatory Requirements: Perform work of this Section in accordance with:

.1 Provincial/Territorial Workers' Compensation Boards/Commissions, Federal Workers' Compensation Service and required workplace safety requirements.

1.7 SITE CONDITIONS

.1 Existing Conditions: Condition of materials identified as being salvaged or demolished are based on their observed condition at time of site examination before tendering.

.2 Existing Hazardous Substances: Departmental Representative has performed a hazardous substances assessment and identified materials requiring abatement as follows:

.1 Hazardous substances are as defined in Hazardous Products Act.

.2 Hazardous substances will be removed by other Contractors as a part of the project before starting electrical work in accordance with work results described in Related Requirements listed above.

.3 Discovery of Hazardous Substances: It is not expected that Hazardous Substances will be encountered in Work; immediately notify Departmental Representative if materials suspected of containing hazardous substances are encountered and perform following activities:

.1 Refer to Section 01 41 00– Regulatory Requirements for directives associated with specific material types.

.2 Hazardous substances will be as defined in Hazardous Products Act.

.3 Stop work in area of suspected hazardous substances.

.4 Take preventative measures to limit users' and workers' exposure, provide barriers and other safety devices and do not disturb.

.5 Hazardous substances will be removed under a separate contract or as a change to Work.

.6 Proceed only after written instructions have been received from Departmental Representative and/or Departmental Representative.

Part 2 Products

2.1 NOT USED REPAIR MATERIALS

.1 General Patching and Repair Materials: Refer to architectural drawings and specifications for listing of patching and repair materials incidental to removal or demolition of components associated with work of this Section.

.2 Electrical Repair Materials: Use only new materials, CSA or ULC labelled as appropriate and matching components remaining after work associated with components identified for removal or demolition are completed.

.3 Firestopping Repair Materials: Use firestopping materials compatible with existing firestopping systems where removal or demolition work affects rated assemblies, restore to match existing fire rated performance.

2.2 SALVAGE AND DEBRIS MATERIALS

.1 Material Ownership: Demolished materials become Contractor ’s property and will be removed from Project site; except for items indicated as being reused, salvaged, reinstalled, or otherwise indicated to remain Departmental Representative property.

.2 Salvaged Materials: Carefully remove materials designated for salvage and store in a manner to prevent damage or devaluation of materials as follows:

.1 Leave main electrical distribution panel in place; panel can be used for temporary construction power for this and subsequent contracts.

Part 3 Execution

3.1 PREPARATION

.1 Protection of Existing Systems to Remain: Protect systems and components indicated to remain in place during selective demolition operations and as follows:

.1 Prevent movement and install bracing to prevent settlement or damage of adjacent services and parts of existing buildings scheduled to remain.

.2 Notify Departmental Representative and cease operations where safety of buildings being demolished, adjacent structures or services appears to be endangered and await additional instructions before resuming demolition work specified in this Section.

.3 Prevent debris from blocking drainage inlets.

.4 Protect mechanical systems that will remain in operation.

.2 Protection of Building Occupants: Sequence demolition work so that interference with use of the building by Departmental Representative and users is minimized and as follows:

.1 Prevent debris from endangering safe access to and egress from occupied buildings.

.2 Notify Departmental Representative and cease operations where safety of occupants appears to be endangered and await additional instructions before resuming demolition work specified in this Section.

3.2 EXECUTION

.1 [Removal] [Demolition] : Coordinate requirements of this Section with information contained in [Section 02 41 19.13] [Section 02 41 19.19] and as follows:

- .1 Disconnect electrical circuits and panel feeders; maintain electrical service and main distribution panel as is, ready for subsequent Work.
- .2 Remove existing luminaires, electrical devices and equipment including associated conduits, boxes, wiring, and similar items unless specifically noted otherwise.
- .3 Disconnect and remove existing fire alarm system including associated conduits, boxes, wiring, and similar items unless specifically noted otherwise.
- .4 Disconnect and remove communication systems including associated conduits, boxes, cabling, and similar items unless specifically noted otherwise.
- .5 Disconnect and remove telephone outlets, associated conduit, cabling and sub terminal backboards and related accessories; maintain telephone service and main terminal backboard as is.
- .6 Perform demolition work in a neat and workmanlike manner:
  - .1 Remove tools or equipment after completion of work, and leave site clean and ready for subsequent renovation work.
  - .2 Repair and restore damages caused as a result of work of this Section to match existing materials and finishes.
- .7 Place weatherproof blank cover plates on exterior outlet boxes remaining after demolition and removal activities.
- .8 Remove existing conduits, boxes, cabling and wiring associated with removed luminaires, electrical devices and equipment.
- .9 Grind off conduits and make flush with surface of concrete where conduits are cast into concrete; seal open ends of conduit with silicone sealant and leave in place.
- .10 Seal open ends of conduit with silicone sealant and leave in place where they are inaccessible or cannot be removed without damaging adjacent construction.

3.3 CLOSEOUT ACTIVITIES

.1 Demolition Waste Disposal: Arrange for legal disposal and remove demolished materials to accredited provincial landfill site or alternative disposal site (recycle centre).

END OF SECTION

Part 1 General

1.1 PRODUCT DATA

.1 Provide product data in accordance with Section [01 33 00- Submittal Procedures] .

1.2 DELIVERY, STORAGE AND HANDLING

.1 Packaging Waste Management: remove for reuse and return of padding, pallets, packaging materials, crates, etc. in accordance with Section 01 74 21.

Part 2 Products

2.1 BUILDING WIRES

.1 Conductors: stranded for [10] AWG and larger. Minimum size: [12] AWG.

.2 Copper conductors: size as indicated, with 600V insulation of cross-linked thermosetting polyethylene material rated RW90 XLPE.

.3 Copper conductors: size as indicated, with thermoplastic insulation type T90 Nylon rated at 600 V.

.4 Neutral supported cable: [1] [3] [2] phase insulated conductors of [Copper] [Aluminum] and one neutral conductor of [Copper] [Aluminum] steel reinforced, size as indicated. Type: [NS90] [NS75] Insulation: [Type NS-1 rated 300 V] [Type NSF-2 flame retardant rated 600 V] .

2.2 TECK 90 CABLE

.1 Cable: in accordance with Section 26 05 00- Common Work Results for Electrical .

.2 Conductors:

- .1 Grounding conductor: copper.
- .2 Circuit conductors: copper, size as indicated.

.3 Insulation:

- .1 Ethylene propylene rubber EP .
- .2 Cross-linked polyethylene XLP .
- .3 Rating:, 600 V.

.4 Inner jacket: polyvinyl chloride material.

.5 Armour: aluminum.

.6 Overall covering: thermoplastic polyvinyl chloride, compliant to applicable Building Code classification for this project .

.7 Fastenings:

- .1 One hole steel straps to secure surface cables 50 mm and smaller. Two hole steel straps for cables larger than 50 mm.

.2 Channel type supports for two or more cables at

.3 Threaded rods: 6 mm diameter to support suspended channels.

.8 Connectors:

.1 Approved for TECK cable.

2.3 ARMOURED CABLES

.1 Conductors: insulated, copper, size as indicated.

.2 Type: AC90.

.3 Armour: interlocking type fabricated from aluminum strip.

.4 Connectors: anti short connectors.

2.4 CONTROL CABLES

.1 Type: LVT: [2] soft annealed copper conductors, sized as indicated:

.1 Insulation: thermoplastic.

.2 Sheath: thermoplastic jacket, and armour of closely wound aluminum wire.

2.5 NON-METALLIC SHEATHED CABLE

.1 Non-metallic sheathed copper cable type: NMD90 nylon, size as indicated.

Part 3 Execution

3.1 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 00- Common Work Results for Electrical.

.2 Perform tests before energizing electrical system.

3.2 GENERAL CABLE INSTALLATION

.1 Terminate cables in accordance with Canadian Electrical Code.

.2 Cable Colour Coding: to Section 26 05 00- Common Work Results for Electrical.

.3 Conductor length for parallel feeders to be identical.

.4 Lace or clip groups of feeder cables at distribution centres, pull boxes, and termination points.

.5 Wiring in walls: typically drop or loop vertically from above to better facilitate future renovations. Generally wiring from below and horizontal wiring in walls to be avoided unless indicated.

.6 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 as required by Canadian Electrical Code.

3.4 INSTALLATION OF TECK90 CABLE (0 -1000 V)

.1 Group cables wherever possible on channels.

.2 Install cable concealed and securely supported by straps.

3.5 INSTALLATION OF ARMOURED CABLES

.1 Group cables wherever possible on channels.

3.6 INSTALLATION OF CONTROL CABLES

.1 Install control cables as required by Canadian Electrical Code.

.2 Ground control cable shield.

3.7 INSTALLATION OF NON-METALLIC SHEATHED CABLE

.1 Install cables.

.2 Install straps and box connectors to cables as required.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section specifies the hangers and supports for electrical systems.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for hangers and supports 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 with manufacturer's written instructions 01 61 00 - Common Product Requirements.

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

.3 Storage and Handling Requirements:

.1 Store materials indoors, off ground, in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect hangers and supports from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

Part 2 Products

2.1 SUPPORT CHANNELS

.1 U shape, size 41 x 41mm, 2.5 mm thick, surface mounted or suspended.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for hangers and supports installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of Departmental Representative.

.2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 INSTALLATION

.1 Secure equipment to solid masonry, tile and plaster surfaces with lead anchors.

.2 Secure equipment to poured concrete with expandable inserts.

.3 Secure equipment to hollow masonry walls or suspended ceilings with toggle bolts.

.4 Secure surface mounted equipment with twist clip fasteners to inverted T bar ceilings. Ensure that T bars are adequately supported to carry weight of equipment specified before installation.

.5 Support equipment, conduit or cables using clips, spring loaded bolts, cable clamps designed as accessories to basic channel members.

.6 Fasten exposed conduit or cables to building construction or support system using straps.

.1 One-hole steel straps to secure surface conduits and cables 50 mm and smaller.

.2 Two-hole steel straps for conduits and cables larger than 50 mm.

.3 Beam clamps to secure conduit to exposed steel work.

.7 Suspended support systems.

.1 Support individual cable or conduit runs with 6 mm diameter threaded rods and spring clips.

.2 Support 2 or more cables or conduits on channels supported by 6 mm diameter threaded rod hangers where direct fastening to building construction is impractical.

.8 For surface mounting of two or more conduits use channels.

.9 Provide metal brackets, frames, hangers, clamps and related types of support structures where indicated or as required to support conduit and cable runs.

.10 Ensure adequate support for raceways and cables dropped vertically to equipment where there is no wall support.

.11 Do not use wire lashing or perforated strap to support or secure raceways or cables.

.12 Do not use supports or equipment installed for other trades for conduit or cable support except with permission of other trade and approval of Departmental Representative.

.13 Install fastenings and supports as required for each type of equipment cables and conduits, and in accordance with manufacturer's installation recommendations.

3.3 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11- Cleaning.

.1 Leave Work area clean at end of each day.

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

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 NOT USED.

1.2 REFERENCE STANDARDS

.1 CSA Group (CSA)

.1 CSA C22.1-[06] , Canadian Electrical Code, Part 1, 20th Edition.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Submit samples for [floor box] in accordance with Section [01 33 00- Submittal Procedures] .

1.4 DELIVERY, STORAGE AND HANDLING

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

.2 Waste Management and Disposal:

.1 Separate waste materials for [recycling] [reuse] in accordance with Section [01 74 19- Waste Management and Disposal] .

Part 2 Products

2.1 OUTLET AND CONDUIT BOXES GENERAL

.1 Size boxes in accordance with CSA C22.1.

.2 [102] mm square or larger outlet boxes as required.

.3 Gang boxes where wiring devices are grouped.

.4 Blank cover plates for boxes without wiring devices.

.5 347 V outlet boxes for 347 V switching devices.

.6 Combination boxes with barriers where outlets for more than one system are grouped.

2.2 GALVANIZED STEEL OUTLET BOXES

.1 One-piece electro-galvanized construction.

.2 [Single] [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.

.3 Utility boxes for outlets connected to surface-mounted EMT conduit, minimum size [102 x 54 x 48] mm.

.4 [102] mm square or octagonal outlet boxes for lighting fixture outlets.

.5 Extension and plaster rings for flush mounting devices in finished [plaster] [tile] walls.

2.3 MASONRY BOXES

.1 Electro-galvanized steel masonry [and multi] [single] gang boxes for devices flush mounted in exposed block walls.

2.4 CONCRETE BOXES

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

2.5 FLOOR BOXES

.1 Concrete tight electro-galvanized sheet steel floor boxes with adjustable finishing rings to suit floor finish with [brass] [brushed aluminum] faceplate. Device mounting plate to accommodate short or long ear [single] [duplex] receptacles. Minimum depth: 73 mm for receptacles and communication outlets.

.2 Adjustable, watertight, concrete tight, cast floor boxes with openings drilled and tapped for [16, 21 and 27] mm conduit. Minimum size: 73 mm deep.

2.6 CONDUIT BOXES

.1 Cast [FS] [aluminum] [FD] boxes with factory-threaded hubs and mounting feet for surface wiring of devices.

2.7 OUTLET BOXES FOR NON-METALLIC SHEATHED CABLE

.1 Electro-galvanized, sectional, screw ganging steel boxes, minimum size [76 x 50 x 63] mm with two double clamps to take non-metallic sheathed cables.

2.8 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.

2.9 SERVICE FITTINGS

.1 'High tension' receptacle fitting made of 2 piece, die-cast aluminum or stainless steel, with satin aluminum or brushed aluminum housing finish, for 1 duplex or two duplex receptacles. Bottom plate with two knockouts for centered or offset installation. [12 x 102 mm extension piece as indicated] .

.2 Pedestal type 'low tension' fitting made of 2 piece stainless steel or die cast aluminum with satin aluminum or brushed aluminum housing finish to accommodate two amphenol jack connectors.

Part 3 Execution

3.1 INSTALLATION

.1 Support boxes independently of connecting conduits.

.2 Fill boxes with paper, sponges or foam or similar approved material to prevent entry of debris during construction. Remove upon completion of work.

.3 For flush installations mount outlets flush with finished wall using plaster rings to permit wall finish to come within 6 mm of opening.

.4 Provide correct size of openings in boxes for conduit, mineral insulated and armoured cable connections. Do not install reducing washers.

.5 Vacuum clean interior of outlet boxes before installation of wiring devices.

.6 Identify systems for outlet boxes as required.

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

.1 CSA Group (CSA)

.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- Submittal Procedures] .

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for panelboards and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Shop Drawings:

.1 Submit drawings reviewed and stamped by contractor.

.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- Closeout Submittals] .

.2 Operation and Maintenance Data: submit operation and maintenance data for panelboards for incorporation into manual.

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.

.2 250 V panelboards, 100amp bus.

.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 Copper bus with neutral of same ampere rating of mains.

.6 Mains: suitable for bolt-on breakers.

.7 Trim with concealed front bolts and hinges.

.8 Trim and door finish: as per colour schedule.

.9 Isolated ground bus.

.10 Include grounding busbar with 3 of terminals for bonding conductor equal to breaker capacity of the panel board.

2.2 BREAKERS

.1 Breakers: to Section [26 28 16.02- Moulded Case Circuit Breakers] .

.2 Breakers with thermal and magnetic tripping in panelboards except as indicated otherwise.

.3 Main breaker: separately mounted on top or bottom of panel to suit cable entry. When mounted vertically, down position should open breaker.

2.3 EQUIPMENT IDENTIFICATION

.1 Provide equipment identification in accordance with Section [26 05 00- Common Work Results for Electrical] .

.2 Nameplate for each panelboard size 4 engraved [as indicated] .

.3 Nameplate for each circuit in distribution panelboards size 2 engraved [as indicated] .

.4 Complete circuit directory with typewritten legend showing location and load of each circuit, mounted in plastic envelope at inside of panel door.

.5 Circuits supplying Patient Care Areas must be entered in circuit directory with Bold Font.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for panelboards installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of Departmental Representative.

.2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 INSTALLATION

.1 Locate panelboards as indicated and mount securely, plumb, true and square, to adjoining surfaces.

.2 Mount panelboards to height specified in Section 26 05 00- Common Work Results for Electrical or as indicated.

.3 Connect loads to circuits.

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

3.3 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11- Cleaning.

.1 Leave Work area clean at end of each day.

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

3.4 PROTECTION

.1 Protect installed products and components from damage during construction.

.2 Repair damage to adjacent materials caused by panelboards installation.

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

.1 CSA Group (CSA)

.1 CSA C22.2 No.42-[10] , General Use Receptacles, Attachment Plugs and Similar Devices.

.2 CAN/CSA C22.2 No.42.1-[00(R2009)] , Cover Plates for Flush-Mounted Wiring Devices (Bi-national standard, with UL 514D).

.3 CSA C22.2 No.55-[M1986(R2008)] , Special Use Switches.

.4 CSA C22.2 No.111-[10] , General-Use Snap Switches (Bi-national standard, with UL 20).

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section [01 33 00- Submittal Procedures] .

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for [wiring devices] and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Shop Drawings:

.1 Submit drawings for all wiring devices, reviewed and stamped by contractor.

1.3 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section [01 78 00- Closeout Submittals] .

.2 Operation and Maintenance Data: submit operation and maintenance data for wiring devices for incorporation into manual.

Part 2 Products

2.1 SWITCHES

.1 15A, 120 V, single pole switches to: 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 White toggle.

.3 Toggle operated, fully rated for tungsten filament and fluorescent lamps, and up to 80% of rated capacity of motor loads and heating loads .

.4 Switches of one manufacturer throughout project.

2.2 RECEPTACLES

.1 Duplex receptacles, CSA type 5-15 R, 125 V, 15 A, (or type 5-20R, 125V, 20A as required), U ground, to: CSA C22.2 No.42 with following features:

.1 white urea moulded housing.

.2 Suitable for No. 10 AWG for back and side wiring.

.3 Break-off links for use as split receptacles.

.4 Eight back wired entrances, four side wiring screws.

.5 Triple wipe contacts and rivetted grounding contacts.

.6 Tamper Resistant.

.2 Provide GFCI type receptacles where indicated.

.3 All existing receptacles shall be replaced with new tamper resistant type.

.4 Other receptacles with ampacity and voltage as indicated.

.5 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 Plastic, white cover plates, thickness 2.5 mm for wiring devices mounted in flush-mounted outlet box.

.4 Weatherproof double lift spring-loaded cast aluminum cover plates, complete with gaskets for duplex receptacles as indicated.

.5 Weatherproof spring-loaded [cast aluminum] cover plates complete with gaskets for single receptacles or switches.

2.4 SOURCE QUALITY CONTROL

.1 Cover plates from one manufacturer throughout project.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for wiring devices installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of Departmental Representative.

.2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 INSTALLATION

.1 Switches:

.1 Install single throw switches with handle in "UP" position when switch closed.

.2 Install switches in gang type outlet box when more than one switch is required in one location.

.3 Mount toggle switches at in accordance with Section 26 05 00- Common Work Results for Electrical .

.2 Receptacles:

.1 Install receptacles in gang type outlet box when more than one receptacle is required in one location.

.2 Mount receptacles at height in accordance with Section 26 05 00- Common Work Results for Electrical.

.3 Where split receptacle has one portion switched, mount vertically and switch upper portion.

.4 Install GFCI type receptacles as indicated.

.5 Replace all existing receptacles with tamper resistant type.

.3 Cover plates:

.1 Install suitable common cover plates where wiring devices are grouped.

.2 Do not use cover plates meant for flush outlet boxes on surface-mounted boxes.

3.3 CLEANING

.1 Progress Cleaning: clean in accordance with Section [01 74 11- Cleaning] .

.1 Leave Work area clean at end of each day.

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

.3 Waste Management: separate waste materials for [recycling] [reuse] in accordance with Section [01 74 19- Waste Management and Disposal] [01 35 21- LEED Requirements] .

.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.4 PROTECTION

.1 Protect installed products and components from damage during construction.

.2 Protect stainless steel cover plate finish with paper or plastic film until painting and other work is finished.

.3 Repair damage to adjacent materials caused by wiring device installation.

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

.1 CSA Group (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- Submittal Procedures] .

.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.

.3 Include time-current characteristic curves for breakers with ampacity of 15A and over with interrupting capacity of 22,000 A symmetrical (rms) and over at system voltage] .

Part 2 Products

2.1 BREAKERS GENERAL

.1 Circuit breakers, Moulded-case circuit breakers, fused circuit breakers, 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.

.3 Plug-in moulded case circuit breakers: quick- make, quick-break type, for manual and automatic operation with temperature compensation for 40 degrees C ambient.

.4 Common-trip breakers: with single handle for multi-pole applications.

.5 Magnetic instantaneous trip elements in circuit breakers to operate only when value of current reaches setting.

.6 Provide arc fault circuit interrupter (AFCI) breakers where indicated on panel schedules and as required by code.

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 MAGNETIC BREAKERS (DESIGN B)

.1 Moulded case circuit breaker to operate automatically by means of magnetic tripping devices to provide instantaneous tripping for short circuit protection.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of Departmental Representative.

.2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 INSTALLATION

.1 Install circuit breakers as indicated.

.2 Provide arc fault breakers feeding outlets in bedrooms and living rooms, and as required by code.

.3 Replace existing breakers feeding outlets in bedrooms and living rooms with arc fault type breakers, to meet code requirements.

3.3 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11- Cleaning.

.1 Leave Work area clean at end of each day.

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

.3 Waste Management: separate waste materials for recycling/reuse in accordance with Section 01 74 19- Waste Management and Disposal.

.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

Part 1 General

1.1 SCOPE

.1 This section specifies the materials and installation for interior and exterior luminaires.

.2 Refer to the Luminaire Schedule on the electrical drawings.

1.2 REFERENCES

.1 CAN/CSA C22.1-15, Canadian Electrical Code, Part I.

.2 CAN/CSA C22.2 No.9.0, General Requirements for Luminaires.

.3 ANSI / UL 8750-2008 – Light Emitting Diode (LED) Equipment for Use in Lighting Products

.4 ANSI / NEMA C78.377-2008 – Specifications for the Chromaticity of Solid State Lighting Products

.5 CAN/CSA-C22.2 No. 250.13-14 – Lighting Emitting Diode (LED) Equipment for Lighting Applications

.6 IEEE C62.41-2002 – Recommended Practice on Characterization of Surges in Low-Voltage (1000V and Less) AC Power Circuits

.7 IESNA LM-79 – Electrical and Photometric Measurements of Solid State Lighting Products

.8 IESNA LM-80 – Measuring Lumen Maintenance of LED Light Sources

.9 IESNA TM-21 – Projecting Long term Lumen Maintenance of LED Light Sources.

1.3 NOT USED.

1.4 ADDITION OF ACCEPTABLE MANUFACTURERS

.1 Material/products considered to satisfy the specification, but of a manufacturer other than those named may be submitted to the Departmental representative for consideration not later than five (5) working days prior to closing of tender or of bid depository subtrade tender whichever is earlier.

.2 Alternate approvals will be given by written addendum only. No other substitution will be permitted after closing of tenders.

.3 Alternate approvals granted before the closing of tenders will be limited to a manufacturer's system and/or series only. This limited approval will not preclude substitute equipment/material from complying with specific features included with equipment/material specified. Determine that the alternate product meets the specification intent before basing a tender on the product.

.4 The departmental representative is not obliged to accept any materials presented for their review and does not need to provide reasons for rejection of proposed alternates.

1.5 PRODUCT DATA

.1 Submit shop drawings and product data in accordance with Section 01 33 00 – Submittal Procedures.

.2 Submit complete photometric and heat dissipation data prepared by independent testing laboratory for proposed luminaires.

1.6 SAMPLE LUMINAIRES

.1 Submit sample luminaires for review prior to manufacturing when requested by the Departmental representative.

.2 Sample luminaires to be operable and complete with lamps, accessories and a plug-in power cord if requested by the Departmental representative.

.3 Deliver samples to the Departmental representative's office or to another location as directed. Collect the sample(s) at the conclusion of the review.

1.7 INTENT

.1 Provide lighting fixtures and accessories for all outlets as listed in the Luminaire Schedule and as shown on drawings.

.2 Lighting fixtures shall be structurally well designed and constructed, using new parts and materials of the highest commercial grade available.

.3 Ground all lighting equipment to grounding system.

.4 Verify all ceiling types and finishes before ordering fixtures and provide fixtures suitable for mounting in or on ceilings being installed in each area, as specified. Where fixture types specified are not suitable for ceiling being installed, obtain written instructions from the Departmental representative before ordering fixtures.

.5 Fixtures of the same or similar type shall be supplied by the same manufacturer.

1.8 QUALITY ASSURANCE

.1 Regulatory Requirements: Luminaires, LEDs, drivers and associated equipment shall meet standards of an electrical testing laboratory and bear a CSA, cUL or cETL label and must operate lamps within ANSI lamp specifications and meet FCC Rules and Regulations, Part 18 (Class A); labels bearing only the marks UL, UL_{us}, ETL or CE will not be acceptable for work of this project.

Part 2 Products

2.1 DRIVERS

.1 Drivers shall typically operate one luminaire unless noted otherwise on the light fixture schedule.

.2 For linear runs of fixtures (interior or exterior), drivers shall typically operate the maximum run length based on the specific distance and wattage limitations.

.3 Driver shall operate from 50/60 Hz input source of 120 volts and sustained variations of +/- 10% (Voltage & Frequency) with no damage to the driver or solid state circuitry.

.4 Total harmonic distortion <10%

.5 Operating Temperature:

.1 Interior: 15°C to 30°C

.2 Exterior: -40°C to 35°C

.6 Surge Protection: Automatic, withstand line transients as defined in ANSI C62.41, Category A

.7 Dimming

.1 Dimming shall be compatible with the lighting control system typically 0-10V low voltage dimming.

.2 Dimming range shall be 1% - 100% of full light output

.3 Drivers shall be dimmable to 1% minimum, flicker free and shall meet IEC 60929 Annex E for maximum control amperage draw of 2mA.

.4 Drivers and dimmers to be fully matched and compatible for the quantity of fixtures being dimmed.

.5 Any substitution to the dimming driver control mechanism which requires extra wiring or materials for the lighting control system to operate shall be paid for by the fixture manufacturer.

.8 Drivers shall have a power factor greater than 0.98

2.2 SOLID STATE LIGHTING

.1 Colour Constancy / CCT:

.1 Correlated colour temperature (CCT) shall be with four (4) MacAdam ellipses of the specified CCT in the luminaire schedule.

.2 Colour consistency between lamps in the same fixture type shall be within two (2) MacAdam ellipses of the rated CCT.

.2 Solid state lighting shall have a CRI greater or equal to the value listed in the luminaire schedule. In addition the lamps shall have an R9 value greater than 50 measured under the same conditions as the CRI.

.3 Solid state lighting systems (including required drivers) shall have a power factor greater than 98 at full rated output.

.4 Photometrics of the fixture containing the LEDs shall be tested according to IESNA LM79 requirements

.5 Minimum L70 lamp life within the fixture of 50,000 hours as measured according to LM80 and TM21.

.6 LEDs to be paired with the appropriate drivers to provide smooth, continuous dimming from 1% to 100% output.

2.3 FIXTURES

.1 Accessories and components shall comply with relevant CSA Standards.

.2 Recessed downlight fixtures

.1 Approved prewired type with junction box forming an integral part of the fixture assembly and so located in relation to the fixture that the junction box is CSA approved for 75 degree C wire.

.2 The electrical trade shall supply and install all necessary plaster rings, supports, etc., required for complete and proper installation.

.3 Except where otherwise noted in the Luminaire Schedule, depth of recessed fixtures shall not exceed 150 mm, including mounting yokes, or bridges. Design of reflector and lamp position shall be to provide high efficiency, even brightness and lack of LED dot image.

.3 Exterior Fixtures

.1 All exterior fixtures to have BUG ratings available.

.2 All exterior luminaries with more than 1000 initial Lamp Lumens to have an uplight component of U<=1

.3 All exterior luminaires with more than 3500 initial lamp lumens to have an uplight component of U=0

.4 Any luminaire within a distance of 2.5 times its mounting height from the property boundary shall have shielding such that no light from that luminaire crosses the property boundary.

.4 All metal parts shall be thoroughly cleaned and finished in high reflectance baked enamel over corrosion-resistant primer. Finish as indicated in luminaire schedule.

.5 All internal fixture diffusers, lens panels, lens frames, etc., shall be securely and adequately supported and shall be removable without the use of tools for cleaning.

.6 Fixtures shall incorporate adequate gasketing, stops and barriers to form light traps and prevent light leaks.

.7 Fixtures shall be designed for adequate dissipation of driver and LED heat to avoid short life, nuisance thermal tripping and decreased lamp output. Heat test reports by independent laboratories shall be provided where required by the Departmental representative.

.8 Construction of all fixtures shall be such as to provide a rigid well aligned fixture. Formed or ribbed backplates, end plates, reinforcing channel, heavy gauge sockets, straps, etc., shall be used where required to accomplish this.

.9 The construction and performance of all fixtures shall be subject to the acceptance of the Departmental representative.

Part 3 Execution

3.1 INSTALLATION AND SUPPORTS

.1 General:

.1 Provide complete and proper support for all fixtures, fixture hangers, etc., including headers in ceiling space, where required, for proper support of outlet boxes and fixture hanger assemblies

.2 Support fixtures as shown on the drawings, level, plumb and true with the structure and other equipment in a horizontal or vertical position as intended. Wall or side bracket mounted fixture housings shall be rigidly installed and adjusted to give a neat flush fit to the surface on which it is mounted.

.3 All hangers, supports, fastenings or accessory fittings shall be protected against corrosion. Care shall be taken during the installation to assure that insulation and corrosion protection is not damaged.

.4 Self aligning seismically rated ball joint hangers shall be used for rod suspended fixtures. Ceiling canopies or hood assemblies intended to cover the suspension attachments shall be installed to fit tightly to the ceiling without restricting the alignment of the hanger. Support fixtures by hangers and mounting arrangements which will not cause the fixture frame, housing, sides or lens frame to be distorted; or prevent complete alignment of several fixtures in a row.

.5 Metal inserts, expansion bolts or toggle bolts in concrete slabs for stems which do not carry wiring must be accurately located in relation to the outlet boxes, to allow perfect alignment and spacing of suspension stems

.2 Recessed Fixtures:

.1 Install so that they are removable from below to gain access to outlet box or prewired fixture box. Connect all recessed fixtures to boxes with flexible conduit and approved fixture wire.

.2 Provide approved drywall enclosures in insulated ceilings. Volume of enclosure to comply with Electrical Code.

.3 In areas without suspended ceilings, support fixtures directly from the structure by rod hangers and inserts

.4 Provide plaster frames or plaster trim as required and turn same over to the ceiling section for installation.

.5 Support fixtures greater than 610mm in width and 610mm in length by four hangers per fixture, minimum, independent of ceiling supports or t-bars. Additional support to be provided as per manufacturer's instructions, with 2440mm as the longest distance between supports.

.6 Support fixtures less than 610mm in width and 610mm in length by two hangers per fixture, minimum, independent of ceiling supports or t-bars. Additional support to be provided as per manufacturer's instructions, with 2440mm as the longest distance between supports.

.3 Suspended Fixtures:

.1 Install suspended linear fixtures with airplane cable and fittings having field adjustable length.

.2 Fixtures shall be installed level unless specifically noted otherwise on drawings, with less than 10mm variation over 2440mm

.3 Fixtures shall be mounted at the same height above the floor unless specifically noted otherwise on drawings.

.4 The suspension length of all ceiling mounted suspended types of lighting fixtures as listed in the Fixture Schedule shall be the overall length from the ceiling to the lowest point of the fixture body, reflector or glassware in its hanging position.

.4 Surface Mounted Fixtures:

.1 Where fixtures are surface mounted on the underside of an inverted tee bar ceiling, the fixture shall be supported either directly from the building structure by means of rod hangers and inserts or by means of metal angle headers, supported from the tee bar framing structure above the tile.

.2 Fixtures shall be supported from the quarter points.

.5 Exterior Fixtures:

.1 Install exterior fixtures using security screws.

.2 Provide one screwdriver of each security head used, to be stored in the electrical room.

.3 Exterior luminaires to be mounted so the maximum candela value of all exterior lighting shall fall within the property.

3.2 LUMINAIRE WIRING

.1 Wiring from outlet boxes to fixtures and wiring through fixture channels shall be rated for 90 degrees C.

.2 Install underground wiring in specified conduit with watertight connections

- .1 Steel conduit to be finished in two coats of asphaltum base paint
- .2 Seal all conduit runs at panels, pullboxes, etc.
- .3 Install green insulated grounding conductor in all runs

.3 Conductors shall be RW90 X-link

3.3 ADJUSTMENT AND CLEANING

.1 Install fixture lenses as late as possible to protect from dirt and dust. Remove and clean or replace lenses to the satisfaction of the Departmental representative.

.2 Specular reflector protection to remain in place through construction.

.3 Align luminaires and clean diffusers, baskets and remove reflector protection prior to final acceptance.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 NOT USED.

1.2 REFERENCE STANDARDS

.1 NOT USED.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for communications equipment and include product characteristics, performance criteria, physical size, finish and limitations.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with 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, off ground, indoors and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect communications equipment from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

.4 Develop [Construction Waste Management Plan] [Waste Reduction Workplan] related to Work of this Section and in accordance with Section [01 35 21- LEED Requirements] .

.5 Packaging Waste Management: remove for reuse [by manufacturer] [and return] of [packaging materials] [crates,] [padding,] [pallets,] as specified in [Construction Waste Management Plan] [Waste Reduction Workplan] in accordance with Section [01 74 19- Waste Management and Disposal] [Section 01 35 21- LEED Requirements] .

Part 2 Products

2.1 TELEPHONE WIRE

.1 Heavy duty drop wire: 3 No. 14 AWG solid hard drawn copper, lead coated, brass plated conductors with styrene butadiene rubber insulation, neoprene jacket twisted in to pair, designed to connect open wire line to cable terminals.

.2 Service wire: 4 [No. 22] AWG solid annealed copper conductors with polyethylene insulation, spiral four lay-up, inner jacket polyvinyl chloride, close serving of flat galvanized steel wire armour, outer jacket of polyvinyl chloride designed for buried service connections.

.3 Underground wire: 2 [No.19] AWG solid annealed copper conductors laid parallel, polyethylene insulation, close serving of flat galvanized steel wire armour, jacket of polyvinyl chloride designed for buried service connections.

.4 Ground wire: 1 No. [14] [6] [12] [10] AWG solid annealed copper conductor with polyvinyl chloride insulation designed for ground connections to protect cable terminals and protectors.

2.2 COAXIAL CABLES FOR TELEVISION CABLE SYSTEMS

.1 Semi-air-dielectric coaxial cable: centre conductor No.10 AWG solid copper, insulation of polyethylene discs [2.16] mm thick, spaced 25 mm apart, outer conductor of longitudinal interlocking copper tape [0.30] mm thick, rated impedance 75 ohms shield of two spiral steel reinforcing tapes and protective covering of:

.1 Longitudinal aluminum tape sealed to medium density polyethylene jacket designed for [trunk] [main feeder] used [aerially] [in ducts] .

.2 Inner jacket of polyethylene, aluminum tape applied longitudinally, corrugated steel tape overlapped and soldered, flooding compound and outer jacket of polyethylene designed for main feeder used for installation in ducts.

.2 Foam-dielectric coaxial cable: centre conductor [No.7] AWG solid copper, insulation of foam [expanded] polyethylene and outer conductor of aluminum, rated impedance 75 ohms designed as main feeder cable for CATV system with protective covering of viscous adhesive flooding compound and medium density polyethylene sheath.

.3 Foam-dielectric coaxial cable designed for distribution cable in CATV system: center conductor No. 13 AWG solid copper, insulation of foam (expanded) polyethylene and outer conductor of aluminum.

.4 Coaxial drop wire: centre conductor [No. 16] AWG copper-covered steel, polypropylene foam insulation, medium density polyethylene skin, two longitudinal drain wires for shielding continuity, outer conductor and shield of polyolefin-coated aluminum tape, and outer jacket of polyvinyl chloride, designed for use [as aerial cable by addition of steel messenger wire attached to cable by figure 8 cross-section PVC jacket] [between distribution cables and building] .

.5 Inner jacket of polyethylene covered by 1% lead antimony jacket designed for ducts.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for communications equipment installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of Departmental Representative.

.2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 INSTALLATION

.1 Install telephone wires on pole line by:

.1 Stringing conductors over cross arms.

.2 Fasten conductors to insulators on first pole.

.3 Tighten conductors to achieve correct sag.

.4 Fasten conductors progressively to insulators on poles until last pole in run is reached.

.2 Install telephone drop wires from pole lines to buildings using drop wire hooks and cable clamps at pole and at building.

.3 Install aerial armoured cables on pole lines by:

.1 Anchoring cable to first pole.

.2 Stringing cable along pole line.

.3 Tightening cable to achieve correct sag using [wire rope sockets] [pulling eyes] to protect outer sheath.

.4 Anchoring cable progressively to each pole until last pole is reached.

.4 Install armoured cables by direct burial using:

.1 Cable plow.

.2 Trench.

.5 Install armoured cables in ducts using [wire rope sockets] [pulling eyes] to protect outer sheath.

.6 Install light wire armoured cable across [marsh] [embankments] [gully] [stream] .

.7 Install single wire armour cables crossing [river] [lakes] .

.8 Install double wire armour cables in [strong tides] [deep water] [heavy ice formations] .

.9 Install telephone service wire between pedestal terminals and building by direct burial in trench.

.10 Install telephone ground wires from pedestals and protectors.

.11 Install main feeder coaxial cable in ducts.

.12 Install main feeder coaxial armoured cable as indicated by direct burial.

.13 Install coaxial drop wire from terminal block on pole to buildings, as indicated, using drop wire hooks and cable clamps at pole and at building[s] .

.14 Install composite video cables:

.1 On pole lines by anchoring cable to first pole, stringing cable along pole line, tightening cable to achieve correct sag using pulling eyes to protect outer sheath, and anchoring cable to each pole until last pole is reached.

.2 By direct burial in trench.

.3 In ducts using pulling eyes to protect outer sheath.

3.3 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11- Cleaning.

.1 Leave Work area clean at end of each day.

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

.3 Waste Management: separate waste materials for [recycling] [reuse] as required.

.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.4 PROTECTION

.1 Protect installed products and components from damage during construction.

.2 Repair damage to adjacent materials caused by communications equipment installation.

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

.1 CSA Group (CSA)

.1 CSA-C22.2 No. 214-[02] , Communications Cables (Bi-National standard with UL 444).

.2 CSA-C22.2 No. 232-[M1988(R2004)] , Optical Fiber Cables.

.2 Telecommunications Industry Association (TIA)/Electronic Industries Alliance (EIA)

.1 TIA/EIA-568-[B.1-(2001)] , Commercial Building Telecommunications Cabling Standard, Part 1: General Requirements.

.2 TIA/EIA-568-[B.2-(2001)] , Commercial Building Telecommunications Cabling Standard, Part 2: Balanced Twisted-Pair Cabling Components.

.3 TIA/EIA-568-[B.3-(2000)] , Optical Fiber Cabling Components Standard.

.4 TIA/EIA-606-[A-(2002)] , Administration Standard for the Commercial Telecommunications Infrastructure.

.5 TIA TSB-140-[2004] , Telecommunications Systems Bulletin - Additional Guidelines for Field-Testing Length, Loss and Polarity of Optical Fiber Cabling Systems.

.6 TIA-598-[C-(2005)] , Optical Fiber Cable Colour Coding.

1.2 DEFINITIONS

.1 Refer to TIA/EIA-598-[C] , Annex A for definitions of terms: optical-fiber interconnect, distribution, and breakout cables.

1.3 SYSTEM DESCRIPTION

.1 Structured telecommunications wiring system consist of unshielded-twisted-pair and optical fibre cables, terminations, connectors, cross-connection hardware and related equipment installed inside building for occupant's telecommunications systems, including voice (telephone), data, and image.

.2 Installed in physical star configuration with separate horizontal and backbone sub-systems.

.1 Horizontal cables link work areas to telecommunications room[s] located on same floor.

.2 Telecommunications rooms linked to main terminal/equipment room (MT/ER) by backbone cables.

.3 MT/ER also linked to Entrance Room by backbone cables.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 As-built Records and Drawings:

.1 Provide [Microsoft Access] database reflecting cable installation and cross-connections.

.2 Provide electronic drawings in [AutoCAD 2000] format depicting all construction.

.3 Provide two (2) bound complete hard-copy sets of as-built records to the [Departmental Representative] [Departmental Representative] [DCC Representative] .

.1 Provide and place one hard copy of as-built records for each telecommunications room in plan holder in each telecommunications room.

1.5 QUALITY ASSURANCE

.1 Health and Safety Requirements: do construction occupational health and safety in accordance with Section [01 35 29.06- Health and Safety Requirements] .

1.6 DELIVERY, STORAGE AND HANDLING

.1 Waste Management and Disposal: separate waste materials for [recycling] [reuse] in accordance with Section [01 74 19- Waste Management and Disposal] .

Part 2 Products

2.1 FOUR-PAIR 100 W BALANCED TWISTED PAIR CABLE

.1 Four-pair, 100 ohm balanced unshielded-twisted-pair (UTP) cable to: CSA-C22.2 No. 214, Category 6 (Cat 6) to: TIA/EIA-568-[B.2] .

2.2 WORK AREA UTP 4-PAIR MODULAR JACK

.1 Eight-position modular jack ("RJ-45"), type Category 6 to: TIA/EIA-568- [B.2]:

.1 In self-contained surface-mount box,

.2 Mounted in compatible double gang faceplate, flush entry.

Part 3 Execution

3.1 INSTALLATION OF TERMINATION AND CROSS-CONNECT HARDWARE

.1 Install termination and cross-connect hardware [in rack] [on wall] [in cabinet] as indicated and according to manufacturers' instructions. Identify and label as indicated to: TIA/EIA-606-[A] .

.2 Install consolidation points, as indicated according to manufacturer's instructions. Identify and label as indicated to: TIA/EIA-606-[A] .

3.2 INSTALLATION OF HORIZONTAL DISTRIBUTION CABLES

.1 Install horizontal cables as indicated concealed in walls, from utility service box to outlet locations indicated.

.2 Support horizontal cables at intervals not exceeding [2] metres.

3.3 FIELD QUALITY CONTROL

.1 Test horizontal UTP cables as specified below and correct deficiencies provide record of results as electronic record.

.1 Perform tests for Permanent Link on installed cables, including spares:

.1 Category 6 using certified level III tester to: TIA/EIA-568-[B.2] .

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 This section of the Specification forms part of the Contract Documents and is to be read, interpreted, and coordinated with all other parts.

.2 Section 22 11 16 Domestic Water Piping.

1.2 REFERENCES

.1 American National Standards Institute/American Water Works Association (ANSI/AWWA)

.1 ANSI/AWWA B300-18, Hypochlorites.

.2 ANSI/AWWA B301-18, Liquid Chlorine.

.3 ANSI/AWWA B303-18, Sodium Chlorite.

.4 ANSI/AWWA C500-19, Metal-Seated Gate Valves for Water Supply Service.

.5 ANSI/AWWA C651-14, Disinfecting Water Mains.

.6 ANSI/AWWA C800-14, Underground Service Line Valves and Fittings.

.2 ASTM International

.1 ASTM A307-14e1, Standard Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile.

.2 ASTM B88M-18, Standard Specification for Seamless Copper Water Tube (Metric).

.3 ASTM C117-17, Standard Test Methods for Material Finer Than 0.075 mm (No. 200) Sieve in Mineral Aggregates by Washing.

.4 ASTM C136/C136M-14, Standard Method for Sieve Analysis of Fine and Coarse Aggregates.

.5 ASTM F714-13(2019), Standard Specification for Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Outside Diameter.

.3 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-8.1-88, Sieves, Testing, Woven Wire, Inch Series.

.2 CAN/CGSB-8.2-M88, Sieves, Testing, Woven Wire, Metric.

.3 CGSB 41-GP-25M-77, Pipe, Polyethylene, for the Transport of Liquids.

.4 CSA International

.1 CAN/CSA-B137 Series-17, Thermoplastic Pressure Piping Compendium. (Consists of B137.0, B137.1, B137.2, B137.3, B137.4, B137.4.1, B137.5, B137.6, B137.8, B137.9, B137.10, B137.11 and B137.12).

.1 CAN/CSA-B137.1-17, Polyethylene Pipe, Tubing, and Fittings for Cold-Water Pressure Services.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for distribution piping materials and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Pipe certification to be on pipe.

1.4 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00 - Closeout Submittals.

.2 Submit record drawings, including directions for operating valves, list of equipment required to operate valves and details of pipe material.

.1 Include top of pipe, horizontal location of fittings and type and valves.

.3 Operation and Maintenance Data: submit operation and maintenance data for pipe and valves, for incorporation into manual.

1.5 DELIVERY, STORAGE AND HANDLING

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

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

.3 Storage and Handling Requirements:

.1 Store materials and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect water distribution piping from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

.4 Develop Construction Waste Management Plan related to Work of this Section.

.5 Packaging Waste Management: remove for reuse of packaging materials as specified in Construction Waste Management Plan in accordance with Section 01 74 21 – Construction Demolition Waste Management and Disposal.

1.6 SCHEDULING OF WORK

.1 Schedule Work to minimize interruptions to existing services.

.2 Submit schedule of expected interruptions for approval and adhere to interruption schedule as approved by Departmental Representative.

.3 Notify Departmental Representative minimum of 24 hours in advance of interruption in service.

1.7 MAINTENANCE MATERIAL SUBMITTALS

.1 Submit in accordance with Section 01 78 00 - Closeout Submittals.

Part 2 Products

2.1 PIPE, JOINTS AND FITTINGS

.1 Polyethylene pressure pipe:

.1 NPS 1/2 to NPS 6: to CAN/CSA-B137.1 type 160.

.2 Polyethylene to polyethylene joints: to be thermal butt fusion joined, to ASTM D2657.

.3 Polyethylene fittings: to CAN/CSA-B137.1, for pipe sizes NPS 4 and less.

2.2 VALVES

.1 Valves to open counter clockwise.

2.3 SERVICE CONNECTIONS

.1 Copper tubing: to ASTM B88M type K, annealed.

.2 Polyethylene pressure pipe:

.1 To CAN/CSA-B137.1, type PE, series 160.

.3 Copper tubing joints: compression type suitable for 1 MPa working pressure.

.4 Polyethylene pipe joints: thermal butt fusion welded or plastic insert type serrated sleeves with four stainless steel screws and band-type clamps per joint.

.5 Brass corporation stops: red brass, compression type having threads to ANSI/AWWA C800.

.6 Brass inverted key-type curb stops: red brass to ASTM B62, compression type without drains.

.7 Polyethylene tapping tees or multi-saddle tees: for Polyethylene pipe. Tees to be socket fused to pipe.

.8 Stainless steel liners for plastic pipe where pipe is used with compression fitting.

2.4 PIPE BEDDING AND SURROUND MATERIAL

.1 Granular material requirements:

.1 Crushed or screened stone, gravel or sand.

.2 Gradations to be within limits specified when tested to CAN/CGSB-8.2.

.3 Table

Sieve Designation	% Passing	
Stone/Gravel	Gravel/Sand	
200 mm	-	-
75 mm	-	-
50 mm	-	-
38.1 mm	-	-
25 mm	100	-
19 mm	-	-
12.5 mm	65-90	100
9.5 mm	-	-
4.75 mm	35-55	80-100
2.00 mm	-	50- 90
0.425 mm	10-25	10- 50
0.180 mm	-	-
0.075 mm	0- 8	0- 10

2.5 BACKFILL MATERIAL

.1 Native material over surround material.

2.6 PIPE DISINFECTION

.1 Disinfect water mains in accordance with ANSI/AWWA C651.

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 distribution piping 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 PREPARATION

.1 Clean pipes, fittings, valves, and appurtenances of accumulated debris and water before installation.

.1 Inspect materials for defects to approval of Departmental Representative.

.2 Remove defective materials from site as directed by Departmental Representative.

3.3 TRENCHING

.1 Ensure trench depth allows coverage over pipe to match existing service pipe depth.

.2 Trench alignment and depth require Departmental Representative's approval prior to placing bedding material and pipe.

3.4 GRANULAR BEDDING

.1 Place granular bedding material in uniform layers not exceeding 150 mm compacted thickness to depth of 150 mm minimum below bottom of pipe or greater if required by plumbing code.

.2 Do not place material in frozen condition.

.3 Shape bed true to grade to provide continuous uniform bearing surface for pipe.

.4 Shape transverse depressions in bedding as required to suit joints.

.5 Compact each layer full width of bed to 95 % minimum of corrected maximum dry density.

3.5 PIPE INSTALLATION

.1 Terminate building water service 1 m outside building wall opposite point of connection to main.

- .1 Install coupling necessary for connection to building plumbing.
- .2 If plumbing is already installed, make connection; otherwise cap or seal end of pipe and place temporary marker to locate pipe end.

.2 Lay pipes to ANSI/AWWA C600 manufacturer's standard instructions and specifications.

- .1 Do not use blocks except as specified.

.3 Join pipes in accordance with manufacturer's recommendations.

.4 Handle pipe by methods recommended by pipe manufacturer. Do not use chains or cables passed through pipe bore so that weight of pipe bears on pipe ends.

.5 Lay pipes on prepared bed, true to line and grade.

- .1 Ensure barrel of each pipe is in contact with shaped bed throughout its full length.
- .2 Take up and replace defective pipe.
- .3 Correct pipe which is not in true alignment or grade or pipe which shows differential settlement after installation greater than 10 mm in 3 m.

.6 Face socket ends of pipe in direction of laying. For mains on grade of 2% or greater, face socket ends up-grade.

.7 Do not exceed permissible deflection at joints as recommended by pipe manufacturer.

.8 Keep jointing materials and installed pipe free of dirt and water and other foreign materials.

- .1 Whenever work is stopped, install a removable watertight bulkhead at open end of last pipe laid to prevent entry of foreign materials.

.9 Position and join pipes with equipment and methods approved by Departmental Representative.

.10 Cut pipes in approved manner as recommended by pipe manufacturer, without damaging pipe or its coating and to leave smooth end at right angles to axis of pipe.

.11 Align pipes before jointing.

.12 Complete each joint before laying next length of pipe.

.13 Minimize deflection after joint has been made.

.14 Apply sufficient pressure in making joints to ensure that joint is completed to manufacturer's recommendations.

.15 Ensure completed joints are restrained by compacting bedding material alongside and over installed pipes or as otherwise approved by Departmental Representative.

.16 When stoppage of work occurs, block pipes in an approved manner to prevent creep during down time.

.17 Recheck plastic pipe joints assembled above ground after placing in trench to ensure that no movement of joint has taken place.

.18 Do not lay pipe on frozen bedding.

.19 Do hydrostatic and leakage test and have results approved by Departmental Representative before surrounding and covering joints and fittings with granular material.

.20 Backfill remainder of trench.

3.6 VALVE INSTALLATION

.1 Install valves to manufacturer's recommendations at locations as indicated.

3.7 SERVICE CONNECTIONS

.1 Terminate building water service 1 m outside building wall opposite point of connection to main.

.1 Install coupling necessary for connection to building plumbing.

.2 If plumbing is already installed, make connection, otherwise cap or seal end of pipe and place temporary marker to locate pipe end.

.2 Do not install service connections until satisfactory completion of hydrostatic and leakage tests of water main.

.3 Construct service connections at right angles to water main unless otherwise directed. Locate curb stops 300 mm inside right-of-way.

.4 Tappings on ductile iron or PVC-C900 pipe, may be threaded without service clamps.

.1 Double strap service connections with galvanized malleable iron body and neoprene gasket cemented in place may be used.

.2 Tappings for PVC-C900 pipe to conform to following:

Pipe Diameter (mm)	Maximum Tap Without Clamp (mm)	Maximum Tap With Clamp (mm)
100	20	25
150	20	40
200	25	50
250	25	50
300	40	75

.5 Maximum dried direct tappings (mm) for ductile iron pipe to conform to:

Nominal Pipe Size (mm)	Pressure Class/Max.				
150	200	250	300	350	
75	-	-	-	-	19
102	-	-	-	-	19
152	-	-	-	-	25
203	-	-	-	-	25
254	-	-	-	-	25
305	-	-	-	-	32
356	-	-	32	38	38

.6 Tappings on PVC pipe to be either PVC valve tees or bronze type service clamps, strap type with "O" ring seal cemented in place.

.7 Tappings for PE pipe: PE tapping tees or multi-saddle tees.

.8 Employ only competent workmen equipped with suitable tools to carry out tapping of mains, cutting and flaring of pipes.

.9 Install single and multiple tap service connections on top half of main, between 45 degrees and 90 degrees measured from apex of pipe.

.10 Leave corporation stop valves fully open.

.11 In order to relieve strain on connections, install service pipe in "Goose Neck" form "laid over" into horizontal position.

.12 Install rigid stainless steel liners in small diameter plastic pipes with compression fittings.

3.8 RESTRAINED JOINTS

.1 For restrained joints: only use restrained joints approved by Departmental Representative.

3.9 HYDROSTATIC AND LEAKAGE TESTING

.1 Do tests in accordance with ANSI/AWWA C600.

.2 Provide labour, equipment and materials required to perform hydrostatic and leakage tests hereinafter described.

.3 Notify Departmental Representative at least 24 hours in advance of proposed tests.

.1 Perform tests in presence of Departmental Representative.

.4 Test pipeline in sections not exceeding 50 m in length, unless otherwise authorized by Departmental Representative.

.5 Upon completion of pipe laying and after Departmental Representative has inspected Work in place, surround and cover pipes between joints with approved granular material placed as directed by Departmental Representative.

.6 Leave valves, joints and fittings exposed.

.7 When testing is done during freezing weather, protect valves, joints and fittings from freezing.

.8 Strut and brace caps, bends, tees, and valves, to prevent movement when test pressure is applied.

.9 Open valves.

.10 Expel air from main by slowly filling main with potable water.

.1 Install corporation stops at high points in main where no air-vacuum release valves are installed.

.2 Remove stops after satisfactory completion of test and seal holes with plugs.

.11 Thoroughly examine exposed parts and correct for leakage as necessary.

.12 Apply hydrostatic test pressure of 1.5 times design working pressure minimum based on elevation of lowest point in main and corrected to elevation of test gauge, for period of 1 hour.

.13 Examine exposed pipe, joints, fittings and appurtenances while system is under pressure.

.14 Remove joints, fittings and appurtenances found defective and replace with new sound material and make watertight.

.15 Repeat hydrostatic test until defects have been corrected.

.16 Apply leakage test pressure of design working pressure minimum after complete backfilling of trench, based on elevation of lowest point in main and corrected to elevation of gauge, for period of 2 hours.

.17 Define leakage as amount of water supplied from water storage tank in order to maintain test pressure for 2 hours.

.18 Locate and repair defects if there is leakage.

.19 Repeat test until leakage is within specified allowance for full length of water main.

3.10 PIPE SURROUND

.1 Upon completion of pipe laying and after Departmental Representative has inspected Work in place, surround and cover pipes as indicated.

.2 Hand place surround material in uniform layers not exceeding 150 mm compacted thickness as indicated.

.3 Place layers uniformly and simultaneously on each side of pipe.

.4 Do not place material in frozen condition.

.5 Compact each layer from pipe invert to mid height of pipe to at least 95 % of corrected maximum dry density.

.6 Compact each layer from mid height of pipe to underside of backfill to at least 90 % of corrected maximum dry density.

3.11 BACKFILL

.1 Place backfill material, above pipe surround, in uniform layers not exceeding 150 mm compacted thickness up to grades as indicated.

.2 Do not place backfill in frozen condition.

.3 Under paving and walks, compact backfill to at least 95% maximum density to ASTM D698.

.1 In other areas, compact to at least 90% corrected maximum dry density.

3.12 FLUSHING AND DISINFECTING

.1 Flushing and disinfecting operations: witnessed by Departmental Representative carried out by contractor.

.1 Notify Departmental Representative at least 4 days in advance of proposed date when disinfecting operations will begin.

.2 Flush water mains through available outlets with a sufficient flow of potable water to produce velocity of 1.5 m/s, within pipe for minimum 10 minutes, or until foreign materials have been removed and flushed water is clear.

.3 Flushing flows as follows:

Pipe Size NPS	Flow (L/s) Minimum
6 and below	38

.4 Provide connections and pumps for flushing as required.

.5 Open and close valves, hydrants and service connections to ensure thorough flushing.

.6 When flushing has been completed to Departmental Representative approval, introduce strong solution of chlorine as approved by Departmental Representative into water main and ensure that it is distributed throughout entire system.

.7 Disinfect water mains.

.8 Chlorine application to be close to point of filling water main and to occur at same time.

.9 Operate valves, hydrants and appurtenances while main contains chlorine solution.

.10 Flush line to remove chlorine solution after 24 hours.

.11 Measure chlorine residuals at extreme end of pipe-line being tested.

.12 Perform bacteriological tests on water main, after chlorine solution has been flushed out.

.1 Take samples daily for minimum of 2 days.

.2 Should contamination remain or recur during this period, repeat disinfecting procedure.

.13 Take water samples at hydrants and service connections, in suitable sequence, to test for chlorine residual.

.14 After adequate chlorine residual not less than 50 ppm has been obtained leave system charged with chlorine solution for 24 hours.

.1 After 24 hours, take further samples to ensure that there is still not less than 10 ppm of chlorine residual remaining throughout system.

3.13 SURFACE RESTORATION

.1 After installing and backfilling over water mains, restore surface to original condition as directed by Departmental Representative.

3.14 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.

.1 Leave Work area clean at end of each day.

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

.3 Waste Management: separate waste materials for recycling in accordance with Section 01 74 21 - Construction Demolition Waste Management and Disposal.

.1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

RCMP Tofino HRV

450 Gibson Street, Tofino, BC

Project No: R. 105895.001

APPENDIX A

INTERIOR FINISH MATERIAL AND COLOUR SCHEDULE

INTERIOR FINISH MATERIAL AND COLOUR SCHEDULE

REFERENCE SPECIFICATION SECTION	ACCEPTABLE PRODUCTS			REMARKS
	LEGEND	MATERIALS	MANUFACTURER / STYLE / COLOUR	
06 40 00 Architectural Woodwork	**PL-1**	Plastic Laminate	Astro Strandz 4940K-18 Linearity Finish by Wilsonart	
	PL-2	Plastic Laminate	Solicor Linen D427-60 Matte finish by Wilsonart	
09 65 99 Resilient Flooring for Minor Works	**SV**	Sheet Vinyl Flooring	“Memories”, by Armstrong (color to be selected from manufacturer’s full standard range)	
09 30 13 Ceramic Tiling	**PRT-1**	Floor Tile – Porcelain	“Unicolour”, colour Taupe, Matte by Olympia	
		Grout	“#11 Sahara Beige” colour by Mapei	
	PRT-2	Wall Tile – Porcelain	“Unicolour”, colour Super White, Polished by Olympia	
		Grout	“#14 Biscuit” colour by Mapei	
	-	Edge Protection (exterior corners & edges of tile surfaces)	“Jolly” by Schluter	
	-	Shower curb corner transition	“DILEX-AHKA” by Schluter	
09 91 23 Interior Painting	**PT**	Paint	DULUX; Color – Bone White DLX1085-2	
10 28 10 Toilet Bath Accessories	**HK**	Bathroom Hook	“Stillness Collection” #K-14458 by Kohler	
	MR	Mirror	“BOBRICK” B-290 series	
	TB	Towel Bar	“Stillness Collection” #K-14391 by Kohler	
	TR	Towel Ring	“Stillness Collection” #K-14456 by Kohler	
	TTH	Toilet Tissue Holder	“Stillness Collection” #K-14393 by Kohler	
	SD	Sliding Shower Door	“Duel” Sliding Shower Door #13627(1) or (2) by Maax	

NOTE:

.1 This schedule is a separate document from the specification and may list specific manufacturers related to patterns and colours upon which the colour scheme for the project is based.

.2 The above “acceptable products” are listed in order to establish a quality of product upon which a price can be tendered. Other products having the same characteristics will not be excluded. Refer to the specification sections as listed for quality specifics.

.3 The Departmental Representative will consider substitute Products which meet or exceed the properties of the specified Product and are similar in material, construction, thickness, colour, texture, and overall quality, provided that proposals are submitted to the Departmental Representative complete with samples and whatever other data the Departmental Representative may require in order to evaluate the proposed substitute Product. If the Departmental Representative approves the proposed substitute Product, the Contractor will have the option of providing Product listed in the Finish schedule or an approved alternative.

END OF SCHEDULE

RCMP Tofino HRV

450 Gibson Street, Tofino, BC

Project No: R. 105895.001

APPENDIX B

PRE-CONSTRUCTION HAZARD ASSESSMENT FORM

Public Works and Government Services Canada | Travaux publics et Services gouvernementaux Canada

RCMP Housing Renovation 450 Gibson Street, Tofino, B.C.
PRELIMINARY HAZARD ASSESSMENT FORM
APPENDIX B

Project Number:	R.105895.001
Location:	Tofino, B.C.
Date:	March 08, 2019
Name of Departmental Representative:	Kai Mark
Name of Client Department:	RCMP
Name of Client or Sr. Project Manager	Kai Mark PH: (604) - 365-0089

Site Specific Orientation Provided at Project Location ☐ **Yes**

Notice of Project Required ☐ **Yes**

NOTE:
PWGSC REQUIRES A Notice of Project FOR ALL CONSTRUCTION WORK RELATED ACTIVITIES

NOTE:
OHS law is made up of many municipal, provincial, and federal acts, regulations, bylaws and codes. There are also many other pieces of legislation in British Columbia that impose OHS obligations.

Important Notice: This hazard assessment has been prepared by PSPC for its own project planning process, and to inform the service provider of actual and potential hazards that may be encountered in performance of the work. PSPC does not warrant the completeness or adequacy of this hazard assessment for the project and the paramount responsibility for project hazard assessment rests with the service provider.

TYPES OF HAZARDS TO CONSIDER	Potential Risk for:				COMMENTS
Examples: Chemical, Biological, Natural, Physical, and Ergonomic Listed below are common construction related hazards. Your project may include pre-existing hazards that are not listed. Contact the Regional Construction Safety Coordinator for assistance should this issue arise.	**PWGSC, OGD's, or tenants**		**General Public or other contractors**		Note: When thinking about this pre-construction hazard assessment, remember a **hazard** is anything that may cause harm, such as chemicals, electricity, working from heights, etc; the **risk** is the chance, high or low, that somebody could be harmed by these and other hazards, together with an indication of how serious the harm could be.
	Yes	**No**	**Yes**	**No**	
Typical Construction Hazards					
Concealed/Buried Services (electrical, gas, water, sewer etc)	yes				
Slip Hazards or Unsound Footing	yes				
Working at Heights	yes				
Working Over or Around Water		no			

Canada

Heavy overhead lifting operations, mobile cranes etc.	yes				
Marine and/or Vehicular Traffic (site vehicles, public vehicles, etc.	yes				Street traffic
Fire and Explosion Hazards	yes				
High Noise Levels	yes				
Excavations	YES				
Blasting		no			
Construction Equipment	yes				
Pedestrian Traffic (site personnel, tenants, visitors, public)	yes				
Multiple Employer Worksite	yes				Federal employees may be visiting site

Electrical Hazards					**Comments**
Contact With Overhead Wires		no			
Live Electrical Systems or Equipment	yes				
Other:					
Physical Hazards					
Equipment Slippage Due To Slopes/Ground Conditions		no			
Earthquake	yes				
Tsunami	yes				
Avalanche		no			
Forest Fires	yes				
Fire and Explosion Hazards	yes				
Working in Isolation	yes				
Working Alone	yes				
Violence in the Workplace	yes				
High Noise Levels	yes				
Inclement weather	yes				
High Pressure Systems		no			
Other:					
Hazardous Work Environments					
Confined Spaces / Restricted Spaces PSPC employees do not enter confined space.	yes				If available, provide the contractor with the existing confined space assessment(s) for information only. Contractor must perform their own confined space assessment as per territorial regulations.
Suspended / Mobile Work Platforms		TBD			
Other:					
Biological Hazards					
Mould Proliferations	yes				See DST Report Dated July 29, 2019 - 450 Gibson Street Tofino, B.C. Pre-Renovation Hazardous Materials Assessment
Accumulation of Bird or Bat Guano		no			
Bacteria / Legionella in Cooling Towers / Process Water		no			

Rodent / Insect Infestation		no			
Poisonous Plants		no			
Sharp or Potentially Infectious Objects in Wastes	yes				
Wildlife	yes				
Chemical Hazards					
Asbestos Materials on Site	yes				See DST Report Dated July 29, 2019 - 450 Gibson Street Tofino, B.C. Pre-Renovation Hazardous Materials Assessment
Designated Substance Present	yes				If “yes” a pre-project designated substance survey report is required.
Chemicals Used in work		no			
Lead in paint	yes				See DST Report Dated July 29, 2019 - 450 Gibson Street Tofino, B.C. Pre-Renovation Hazardous Materials Assessment
Mercury in Thermostats or Switches	yes				See DST Report Dated July 29, 2019 - 450 Gibson Street Tofino, B.C. Pre-Renovation Hazardous Materials Assessment
Application of Chemicals or Pesticides		no			
PCB Liquids in Electrical Equipment		TBD			See DST Report Dated July 29, 2019 - 450 Gibson Street Tofino, B.C. Pre-Renovation Hazardous Materials Assessment
Radioactive Materials in Equipment		no			
Other:					
Contaminated Sites Hazards					
Hazardous Waste		no			
Hydrocarbons		no			
Metals		no			
Other:					

Security Hazards					**Comments**
Risk of Assault	yes				
Other:					
Other Hazards					
Silica and particulate matter from the demolition process.	yes				See DST Report Dated July 29, 2019 - 450 Gibson Street Tofino, B.C. Pre-Renovation Hazardous Materials Assessment

Other Compliance and Permit Requirements[1]	**YES**	**NO**	**Notes / Comments[2]**
Is a Building Permit required?			
Is an Electrical permit required?			

Is a Plumbing Permit required?			
Is a Sewage Permit required?			
Is a Dumping Permit required?			
Is a Hot Work Permit required?	**yes**		
Is a Permit to Work required?		**no**	Mandatory for ALL AFD managed work sites.
Is a Confined Space Entry Permit required?	**yes**		Mandatory
Is a Confined Space Entry Log required	**yes**		Mandatory for all Confined Spaces
Discharge Approval for treated water required			

Notes:

(1) Does not relieve Service Provider from complying with all applicable federal, provincial, and municipal laws and regulations.

(2) TBD means To Be Determined by Service Provider.

Service Provider Acknowledgement: We confirm receipt and review of this Pre-Project Hazard Assessment and acknowledge our responsibility for conducting our own assessment of project hazards, and taking all necessary protective measures (which may exceed those cited herein) for performance of the work.			
Service Provider Name			
Signatory for Service Provider		**Date Signed**	
RETURN EXECUTED DOCUMENT TO PSPC DEPARTMENTAL REPRESENTATIVE PRIOR TO ANY WORK COMMENCING			

RCMP Tofino HRV

450 Gibson Street, Tofino, BC

Project No: R. 105895.001

APPENDIX C

REPORTS

Public Services and Procurement Canada | Services publics et Approvisionnement Canada

BUILDING #E0841 – 450 GIBSON STREET, TOFINO, BC
PRE-RENOVATION HAZARDOUS MATERIAL ASSESSMENT

Project Number R.105895.001

Report prepared for:

Public Services and Procurement Canada, Environmental Services
Services Publics et Approvisionnement Canada, Services environnementaux
Suite 219 – 800 Burrard Street
Vancouver, B.C.
V6Z 0B9

Report prepared by:

DST Consulting Engineers Inc.
Unit B – 4125 McConnell Drive
Burnaby, B.C.
V5A 3J7

DST consulting engineers

EXECUTIVE SUMMARY

DST Consulting Engineers Inc. (DST) was retained by Public Services and Procurement Canada (PSPC) for the purposes of completing a pre-renovation hazardous building materials assessment of the two-storey residential dwelling located at 450 Gibson Street, in Tofino, BC (herein referred to as the Subject Building).

The assessment was completed to identify the presence or absence of asbestos-containing materials (ACMs), lead-based coatings (LBCs), mould amplification, polychlorinated biphenyls (PCBs), elemental mercury, halocarbon and ozone-depleting substances (ODS), crystalline silica, and animal droppings, in preparation for demolition activities planned for the Subject Building, and to provide appropriate recommendations based on the findings of our assessment.

The assessment was completed on July 18th, 2019, by Aaron Enquist, P.Ag., Environmental Technologist of DST.

Asbestos-Containing Materials (ACMs)

Based on the findings of the assessment, the following ACMs were identified within the Subject Building:

- The previously identified drywall joint compound throughout the Subject Building is to be considered asbestos-containing. The asbestos-containing drywall joint compound was found to be **GOOD** condition at the time of the assessment. The drywall amounts to approximately 6,000 ft^2.

- The previously identified ceiling texture coat throughout the Subject Building is to be considered asbestos-containing. The asbestos-containing ceiling texture coat was found to be **GOOD** condition at the time of the assessment. The ceiling texture coat amounts to approximately 1,000 ft^2.

Lead-Based Coatings (LBCs)

Based on the results of DST's assessment and the analytical results, three (3) of the ten (10) suspected LBCs were found to contain hazardous levels of lead, i.e., equal to or > 0.05 mg/cm^2.

The following LBCs were identified to have hazardous levels of lead:

- White paint applied to the door trim found around the entrance to each bedroom and washroom in the main floor hallway of the Subject Building;
- White paint applied to the walls in each bedroom and ensuite washroom of the Subject Building;
- Cream paint applied to the ceiling in the kitchen of the Subject Building.

Halocarbon and Ozone Depleting Substances (ODSs)

No equipment suspected to contain halocarbon and ozone-depleting substances, including refrigerators, freezers, or air conditioning units, were identified within the Subject Building at the time of the assessment.

Elemental Mercury

Light fixtures with compact fluorescent bulbs were observed throughout the Subject Building and are known to contain mercury vapor.

Mercury containing equipment was noted to be in GOOD condition at the time of the assessment.

Polychlorinated Biphenyl's (PCBs)

No equipment suspected to contain PCBs were identified within the Subject Building at the time of the assessment.

Mould Amplification

Mould amplification was identified on the ceiling of the ensuite washroom, located on the main floor of the Subject Building. The mould amounts to approximately 2 feet^2.

According to the previous report by WSP, mould growth was observed at the north wall and ceiling of the master bedroom, the northeast wall at ceiling of the corner bedroom, and north wall at ceiling of the northwest bedroom. Mould was also observed by WSP on the roof sheeting in the attic.

Crystalline Silica

Sources of crystalline silica and rock dust were identified in the concrete perimeter foundation. The concrete was noted to be in **GOOD** condition, posing a **LOW RISK** of exposure.

Rodent Droppings

No rodent droppings were observed during the site assessment within the Subject Building.

Asbestos-Containing Materials (ACMs)

Prior to any renovation and/or demolition activities, identified ACMs should be removed in accordance with the requirements of the Canada Labour Code, Part II, Public Services and Procurement Canada – Asbestos Management Standard, effective June 5, 2017 and

WorkSafeBC, specifically but not limited to include those requirements prescribed through Parts 5.48-5.59 – Controlling Exposure, and Parts 6.1 - 6.32 – Asbestos.

DST recommends reference to WorkSafeBC publication "*Safe Handling of Asbestos, A Manual of Standard Practices"*. This document provides a guide to current practices that are to be followed in the Province of British Columbia, providing basic information on asbestos and asbestos products, health hazards and requirements for worker protection, safe work procedures and principles that should be followed in selecting the most suitable technique for the safe abatement of ACMs.

Asbestos-containing wastes should be managed in accordance with the British Columbia Ministry of Environment and should be transported in accordance with the requirements of the Federal Transportation of Dangerous Goods Act.

Lead-Based Coatings (LBCs)

DST recommends that LBCs identified to be in poor condition be repaired or removed in accordance with the requirements of WorkSafeBC, namely, the requirements stipulated in the WorkSafeBC Guideline "*Safe Work Practices for Handling Lead*", latest edition.

Control the preparation of painted surfaces in accordance with the requirements of WorkSafeBC, specifically but not limited to include those requirements prescribed in Parts 5.48-5.59 – Controlling Exposure and Parts 6.59-6.69 – Lead of the BC OH&S Regulation. Working in proximity to identified LBCs presents a low risk of exposure. As such, DST would recommend Low Risk safe work procedures for demolition activities that will be conducted in close proximity to identified LBCs.

DST recommends reference to WorkSafeBC publication "*Safe Work Practices for Handling Lead*", latest edition. This manual provides a guide to current practices that are to be followed in the Province of British Columbia, providing basic information on lead and lead products, health hazards and requirements for worker protection, safe work procedures and principles that should be followed in selecting the most suitable technique for the safe abatement of LBCs.

Lead-containing wastes should be disposed of in accordance with the British Columbia Ministry of Environment and should be transported in accordance with the requirements of the Federal Transportation of Dangerous Goods Act.

Elemental Mercury

When taken out of service, mercury-containing wastes should be managed in accordance with the requirements of the British Columbia Ministry of Environment and should be transported in accordance with the requirements of the Federal Transportation of Dangerous Goods Act.

Mould Amplification

Based on the findings of this assessment, DST recommends the following:

- Have a qualified remediation contractor remediate identified mould-impacted areas and or moisture elevated building materials. Complete the restoration work in accordance with procedures detailed in WorkSafeBC guideline, entitled *"G4.79 Moulds and Indoor Air Quality Guideline*";
- Have a qualified contractor abate the identified ACMs and LBCs of the identified mould-impacted areas and or moisture elevated building materials in accordance with BC OH&S Regulations and Guidelines;
- Once all remedial work has been completed retain a qualified person to conduct a final clearance inspection of all impacted areas;
- Have a qualified furnace and ducting contractor inspect and clean all ducting and furnace filtration systems.

Crystalline Silica

Through the course of renovation activities, the concrete building foundation and should be wetted (saturated) with water, prior to, during and upon completion of mechanical renovation activities in an effort to minimize the potential for crystalline silica or rock dust release.

Appendices

1.0 INTRODUCTION

DST Consulting Engineers Inc. (DST) was retained by Public Services and Procurement Canada (PSPC) for the purposes of completing a pre-renovation hazardous building materials assessment of the two-storey residential dwelling located at 450 Gibson Street, in Tofino, BC (herein referred to as the Subject Building).

The assessment was completed to identify the presence or absence of asbestos-containing materials (ACMs), lead-based coatings (LBCs), mould amplification, polychlorinated biphenyls (PCBs), elemental mercury, halocarbon and ozone-depleting substances (ODS), crystalline silica, and animal droppings, in preparation for demolition activities planned for the Subject Building, and to provide appropriate recommendations based on the findings of our assessment.

The assessment was completed on July 18th, 2019, by Aaron Enquist, P.Ag., Environmental Technologist of DST.

This report provides an outline of applicable regulations and guidelines, our methodology, the results of the assessment, and conclusions with appropriate recommendations.

2.0 BACKGROUND INFORMATION ON ASBESTOS AND LEAD-BASED COATINGS

Asbestos is a family of naturally occurring fibrous silicates from two mineralogical groups:

- Serpentines, which include chrysotile (white asbestos). These fibres are pliable, curly and made up of tiny individual fibrils. They are spiral in shape; and,
- Amphiboles, which include amosite (brown asbestos) and crocidolite (blue asbestos). These fibres are straight and needle like.

The qualities of asbestos which promoted its use in construction are as follows:

- fire resistance;
- tensile strength;
- durability;
- flexibility; and,
- resistance to heat, wear and corrosion.

Asbestos has many building applications which include:

- Effective insulator against heat, cold, electricity and noise;
- Used as sprayed insulation and fireproofing materials in the period following the Second World War until about 1973;

- Used as a thermal insulator in pipes, boilers and incandescent light reflectors;
- Structural steelwork fireproofing of high-rise buildings;
- Acoustical and decorative purposes in ceiling tiles and building walls; and,
- Durability in floor tiles, wall board, roof shingles and felts, gaskets, caulking, wall and ceiling plasters.

2.1 Potential Health Effects – Asbestos

The primary health-related concern of the above list is asbestos inhalation. Respiratory diseases such as asbestosis (lung scarring) and cancers have been clinically linked to prolonged and heavy occupational exposure to airborne asbestos.

2.2 Classification of Asbestos Products

ACMs are classified into two different groups, either friable or non-friable by the following definitions:

- Friable means a material that when dry can easily be crumbled or powdered. Examples of friable ACMs include fireproofing, acoustic plaster, and mechanical insulating cements.

- Non-friable means a material that, when dry, cannot be easily crumbled or powdered by hand. Examples of non-friable ACMs include floor tiles, asbestos cement board and pipe, and brake shoes.

2.3 Lead-Based Coatings

Lead-based coatings (paints, glazing on ceramic tiles, etc.) were commonly used in buildings up until the late 1970's. Older buildings in Canada may have lead-based paints on walls, ceilings, trim and exterior painted surfaces. Lead is a highly toxic metal that can cause a range of health-related problems, especially in young children. When lead is absorbed into the body, it can cause damage to the brain and other vital organs, such as the kidney, nerves and blood.

The concentration of lead in surface coatings was limited to 600 parts per million (PPM) through the Surface Coating Material Regulation (Health Canada) in 2005. In 2009, Health Canada further limited the concentration of lead in surface coatings to <90 PPM.

In Provincial jurisdictions (specifically British Columbia), WorkSafeBC suggests that improper removal of paint and/or surface coatings with a lead concentration of 600 PPM or more can result in airborne lead concentrations that exceed 50% of the time weighted average (TWA) exposure limit of 0.05 mg/m^3. As such, WorkSafeBC suggests that an exposure control plan and lead risk

assessment be implemented for the disturbance of lead-based coatings that contain >600 PPM of lead.

3.0 REGULATIONS AND GUIDELINES

3.1 Federal Regulations

3.1.1 Canada Labour Code

In federal jurisdictions, hazardous building materials are regulated under the *Canada Labour Code, Part II*, *Part X, Hazardous Substances*.

3.1.2 Asbestos-Containing Materials (ACMs)

ACMs are regulated under the Canada Occupational Health and Safety Regulations, (SOR/86-304). An asbestos-containing material is defined as a manufactured product that contains >0.5 % asbestos fibres by weight, at the time of manufacture, or vermiculite insulation that contains any asbestos fibres.

Vermiculite insulation is commonly found in the hollow cores of cinderblock walls, masonry brick, used as attic / floor cavity insulation, as well as an additive in wall / ceiling plaster compounds. As per WorkSafeBC requirements, vermiculite that contain any asbestos fibres, regardless of concentration, must be considered asbestos-containing. The recommended sample volume for vermiculite insulation is ~ one (1) Litre and analysis can be completed following US EPA analytical method EPC/600/R-93/116, or by Transmission Electron Microscopy (TEM) analysis.

In addition, PSPC has developed the Asbestos Management Standard, effective June 5, 2017, that provide specific requirements for the management and abatement of ACMs.

3.1.3 Lead-Based Coatings (LBCs)

The *Hazardous Products Act (HPA), Surface Coating Materials Regulation (SOR/2005-109)* provides regulatory requirements for the sale and labeling of surface coatings.

The Surface Coating Materials Regulation reduced the threshold for lead in paint from 5,000 mg/kg to 600 mg/kg, and in 2010, to 90 mg/kg. However, Provincial regulations do not require lead controls for surface coatings containing <600 mg/kg, as such, DST identifies a lead-based coating as a coating containing >600 mg/kg or >0.05 mg/cm^2 (by XRF analyzer).

3.1.4 Halocarbon and Ozone Depleting Substances (ODS)

Halocarbon and Ozone Depleting substances are regulated under the Canadian Environmental Protection Act (CEPA), "*Federal Halocarbon Regulations, 2003, (SOR/2003-289)".*

3.1.5 Polychlorinated Biphenyl's (PCBs)

PCBs are regulated under the Canadian Environmental Protection Act, specifically under the *"PCB Regulations"* (SOR/2008-273), including amendments up to the date of this report.

3.1.6 Transportation of Dangerous Goods Act

The Transportation of Dangerous Goods Act provides detailed requirements for the transportation of hazardous materials.

3.2 Provincial Regulations

In British Columbia, the management of hazardous building materials in the work place is regulated by WorkSafeBC under the Workers' Compensation Act (effective April 15, 1998), as amended by the Workers' Compensation (Occupational Health and Safety) Amendment Act (effective October 1, 1999). Specific requirements of the Occupational Health and Safety Amendment Act are prescribed in the British Columbia Occupational Health and Safety (BC OH&S) Regulation.

3.2.2 Mould Amplification

Mould-impacted building materials are regulated under Part 4, section 4.79 of the BC OH&S Regulation.

3.2.3 Elemental Mercury

Mercury-containing equipment is regulated under Part 5, section 5.49 of the BC OH&S Regulation.

3.2.4 Crystalline Silica

Rock dust, nuisance dust (including the respirable fraction), crystalline silica, etc. are regulated under the BC OH&S Regulations, specifically Section 5.0 "*Controlling Exposure*", and 6.111 "*Rock Dust Control*".

3.3 Hazardous Wastes

In British Columbia, environmental matters pertaining to waste generally fall under the jurisdiction of the British Columbia Ministry of Environment (MoE), pursuant to the Environmental Management Act. The key waste regulation under the Environmental Management Act relating to hazardous building materials is the Hazardous Waste Regulation (HWR), as amended from time to time. The HWR provides the requirements for the proper handling, storage, transportation, treatment, recycling and disposal of hazardous wastes in the province. The regulation also outlines the materials and criteria to be used to characterize waste as hazardous.

4.0 METHODOLOGY

The site review and sampling was completed by DST on July 18h, 2019. DST referenced a report prepared by The Pinchin Group (Pinchin) entitled "*Asbestos Building Materials Survey Report, Building #E0841*", dated March 2018, and a report by WSP Canada Inc. (WSP) entitled *"Building Envelope Condition Assessment"*, dated April 2019 (herein referred to as the Previous Reports)

Suspect hazardous building materials were visually identified, based on the surveyor's knowledge of the historic composition of building products. Visual identification of materials suspected to contain hazardous materials were supported by the analysis of representative samples.

Public Services and Procurement Canada Asbestos Management Standard (June 5, 2017), Section 6.1.2.2 recommends adherence to Provincial / Territorial regulations with respect to bulk sampling frequency.

Part 6 and Part 20 of the British Columbia Occupational Health and Safety Regulation provide recommended sampling frequency based on the nature and type of suspected ACMs. Specifically, WorkSafeBC Guideline G20.112 – Hazardous Materials – Asbestos (WorkSafeBC Guideline), specifically, Part 20 provides guidance on the minimum number of bulk samples that should be collected to identify any asbestos that may be present in a residential, industrial or commercial building, prior to renovation, demolition and/or salvage work.

The WorkSafeBC Guideline was developed using the United States Environmental Protection Agency (US EPA) Asbestos Hazard Emergency Response Act (AHERA) sampling frequency. The AHERA sampling protocol provides recommendations for minimum sampling frequency of suspected, friable and non-friable, non-manufactured (i.e. non-homogeneous) building materials. The AHERA sampling protocol does not provide a sampling frequency with respect to homogeneous, non-friable ACMs. The AHERA sampling protocol states that sampling should be completed in a sufficient manner based on site conditions. As such, DST employed a methodology of collecting at least one (1) sample of each visually distinct non-friable, suspected ACMs.

Through the on-site assessments, DST assessed each suspected ACM to determine homogeneity of the application. For homogenous (i.e. manufactured products, including flooring materials, mastics, putties, etc.) materials, one sample of each visually distinct type of application was sampled. For non-homogenous materials (i.e. drywall joint compound, ceiling texture coats, etc.), representative samples were collected based on surface area of the above-mentioned materials.

Suspect LBCs samples were tested for lead content using a Niton X-Ray Fluorescence (XRF) spectroscopy detector. The Niton XRF is designed to detect and quantify the amount of lead

present in painted surfaces. Measurements were made following Niton XRF standard operating procedures for lead in surface coating measurements.

Suspected ozone-depleting substances (ODSs), elemental mercury, sources of polychlorinated biphenyls (PCBs), mould amplification, crystalline silica, and rodent droppings were visually identified based on appearance, age, and knowledge of historic applications/locations.

4.1 Methodology – Asbestos Condition and Risk Assessment

For the purposes of this assessment, DST employed the recommended criteria for control of ACMs in Federally regulated workplaces as contained within the Public Services Procurement Canada, Asbestos Management Standard (June 5, 2017), specifically the risk matrix contained within "*Annex A – Evaluation of Asbestos-Containing Materials and Recommendations for Control"*, further detailed below:

Spray Applied Fireproofing, Insulation and Texture Finishes

To evaluate the condition of ACM spray applied as fireproofing, thermal insulation, or texture, decorative or acoustic finishes, the following criteria are applied:

GOOD
Surface of material shows no significant signs of damage, deterioration or delamination. Up to 1 percent visible damage to surface is allowed within range of **GOOD**. Evaluation of sprayed fire-proofing requires the surveyor to be familiar with the irregular surface texture typical of sprayed asbestos products. **GOOD** condition includes un-encapsulated 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 1 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 survey or re-assessment form.

NOTE: FAIR condition is not utilized in the evaluation of the 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 are advised to be watchful for ACM **DEBRIS** prior to accessing or working above ceilings in areas of buildings with ACM regardless of the reported condition.

Mechanical Insulation

The evaluation of the condition of mechanical insulation (on boilers, breaching, ductwork, piping, tanks, equipment etc.) utilizes the following criteria:

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 penetrating 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. It is not possible to observe the full length 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 should 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 (from floor level) 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, e.g. tops of equipment, mezzanines.

ACCESS (C) EXPOSED
Areas of the building above 2.4 metres where use of a ladder is required to reach the ACM. Only refers to ACM that is exposed to view, from the floor or ladder, without the removal or opening of other building components such as ceiling tiles, or service access door or hatch. 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 will be 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 condition and extent of ACM is limited or impossible, depending on the surveyor's ability to visually examine materials in ACCESS D.

ACM DEBRIS

DEBRIS from Friable ACM

The presence of fallen ACM is noted separately from the presumed friable ACM source (sprayed fireproofing, thermal insulation, texture, decorative or acoustic finishes or mechanical insulation) and is referred to as **DEBRIS**.

DEBRIS from Damaged Non-Friable ACM

The presence of fallen ACM from damaged non-friable ACM is also reported separately from the non-friable ACM source. Only fallen non-friable ACM that has become friable is reported as **DEBRIS**.

The identification of the exact location or presence of **DEBRIS** on the top of ceiling tiles is limited by the number of observations made and the presence of building components such as ducts or full height walls that obstruct observations. Workers are advised to be watchful for the presence of **DEBRIS** prior to accessing or working in proximity to mechanical insulation or above ceilings in areas of buildings with ACM regardless of the reported presence or absence of **DEBRIS.**

Action Matrix and Action Descriptions

The Asbestos Management Plan requires the following responses:

- Immediately clean-up **DEBRIS** that is likely to be disturbed.
- Remove, repair or enclose friable ACM in **POOR** or **FAIR** condition whose continued deterioration will result in **DEBRIS** that is likely to be disturbed.

The following factors shall be considered in making site-specific recommendations for compliance with the existing applicable regulations or codes and the practical implementation of the Asbestos Management Plan:

1. ACM in **POOR** condition is not routinely repairable. If an abatement action is necessary, removal is the recommended action (enclosure is a viable option in unusual circumstances, e.g. where removal is difficult or costly and the asbestos-containing material can be thoroughly enclosed).

2. Mechanical insulation in **FAIR** condition will be repaired or removed based on the following general recommendations, applied on a case-by-case basis:
    - ACM insulation found in **FAIR** condition in ACCESS (B) or ACCESS (C) EXPOSED areas is to be repaired.
    - ACM mechanical insulation found in **FAIR** condition in ACCESS (B) and ACCESS (C) EXPOSED areas, where future damage to the ACM is likely to occur, is to be removed.

3. ACM in **GOOD** condition present in ACCESS (A) can be managed by surveillance, as long as it is not disturbed by future renovation, maintenance or demolition. Proactive removal of the ACM in ACCESS (A) will be considered where damage is possible by on-going occupant activity (accidental or intentional).

4. Non-friable or manufactured products are considered in the action matrix as follows:
    - Non-friable and manufactured products reported in **POOR** condition, or friable **DEBRIS** resulting from the deterioration of non-friable ACM, are treated as friable materials and the appropriate action, and depending on accessibility is determined from the action matrix for friable ACM.

- For non-friable or manufactured products reported in **GOOD** condition, Action 7 (surveillance) is recommended regardless of accessibility.

5. All asbestos-containing material from a particular area is to be removed where small quantities of asbestos are present and removal will negate the need for the use of an Asbestos Management Program in that area.

The action matrix provided below establishes the recommended asbestos control action. The ACTIONS themselves are described in full following the table.

Action Matrix Tables

FRIABLE ACM				
ACCESS	**CONDITION**			**DEBRIS**
	GOOD	**FAIR**	**POOR**	
(A)	ACTION 5/7[1]	ACTION 5/6[2]	ACTION 3	ACTION 1
(B)	ACTION 7	ACTION 6/5[3]	ACTION 3	ACTION 1
(C) EXPOSED	ACTION 7	ACTION 6	ACTION 4	ACTION 2
(C) CONCEALED	ACTION 7	ACTION 7	ACTION 4	ACTION 2
(D)	ACTION 7	ACTION 7	ACTION 7	ACTION 7

[1] If material in **ACCESS (A)/GOOD** condition is not removed **ACTION 7** is required.
[2] If material in **ACCESS(A)/FAIR** condition is not removed **ACTION 6** is required.
[3] Remove ACM in **ACCESS (B)/FAIR** condition if ACM is likely to be disturbed.

Action Descriptions

ACTION 1 - Immediate Clean-Up of DEBRIS that is Likely to Be Disturbed

Access that is likely to cause a disturbance of the ACM **DEBRIS** is to be restricted and **clean up ACM DEBRIS is to be done immediately**. Use correct asbestos procedures. This action is required for compliance with regulatory requirements and good practice. The assessor should immediately notify the Asset or Property and Facility Manager, or Regional/Area Asbestos Management Coordinator of this condition.

ACTION 2 - Intermediate risk 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 using intermediate risk 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 and good practice. Utilize asbestos procedures appropriate to the scope of the removal work.

ACTION 4 - Access into areas where asbestos-containing material is present and likely to be disturbed by access requires intermediate risk precautions.
Intermediate risk asbestos precautions are to be used when entry or access into an area is likely to disturb the ACM. **ACTION 4** must be used until the ACM is re-moved (Use **ACTION 1** or **2** if **DEBRIS** is present). Intermediate risk or high risk precautions should be used for removal (depending on extent of removal).

ACTION 5 - Proactive ACM Removal
Removal of ACM in lieu of repair may be considered, even if it is in **GOOD** condition at locations, where ACM is easily accessible, limited in quantity, and removal would be cost-effective.

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 re-pair 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, **ACTION 5** is to be implemented.

ACTION 7 - Routine Surveillance
Institute routine surveillance of the ACM. Trained workers or contractors must use appropriate asbestos precautions (low, intermediate or high) during disturbance of the remaining ACM.

5.0 FINDINGS AND CONCLUSIONS

5.1 Asbestos-Containing Materials (ACMs)

Based on the findings of the assessment, the following ACMs were identified within the Subject Building:

- The previously identified drywall joint compound throughout the Subject Building is to be considered asbestos-containing. The asbestos-containing drywall joint compound was found to be **GOOD** condition at the time of the assessment. The drywall amounts to approximately 6,000 ft^2.

- The previously identified ceiling texture coat throughout the Subject Building is to be considered asbestos-containing. The asbestos-containing ceiling texture coat was found to be **GOOD** condition at the time of the assessment. The ceiling texture coat amounts to approximately 1,000 ft^2.

5.2 Lead-Based Coatings (LBCs)

Suspect LBC samples that were determined to contain a concentration of lead equal to or >0.05 mg/cm^2 were classified as LBCs, i.e., paints with hazardous levels of lead.

In total, DST identified ten (10) suspected LBCs in the Subject Building. A description of the coatings tested, sample point locations and analytical results are summarized in **Table 1, below.** Drawings indicating sample point locations are presented in **Appendix I Floor Plans with Sample Locations**.

Table 1: Analysis of Suspect LBCs

Sample Number	Location / Description	Color	Substrate	Total Lead (mg/cm^2)	Lead-Based Coating	Condition
Basement						
L-1	Walls Throughout	Cream Paint	Drywall	<LOD	No	N.A.
L-2	Baseboards Throughout	White Paint	Wood	<LOD	No	N.A.
L-3	Door to Side Entrance	White Paint	Wood	<LOD	No	N.A.
L-4	Floor in Storage Room	Grey Paint	Concrete	<LOD	No	N.A.
Main Floor						
L-5	Walls in Kitchen & Living Room	Cream Paint	Drywall	<LOD	No	N.A.
L-6	**Door Trim in Hallway – East End**	**White Paint**	**Wood**	**0.05**	**Yes**	**Good**
L-7	**Walls in Bedrooms and Ensuite Washroom**	**White Paint**	**Drywall**	**0.05**	**Yes**	**Good**
L-8	Washroom Walls	Cream Paint	Drywall	<LOD	No	N.A.
L-9	**Kitchen Ceiling**	**Cream Paint**	**Drywall**	**0.07**	**Yes**	**Good**
Exterior						
L-10	Carport – Columns	White Paint	Wood	<LOD	No	N.A.

Notes: **Bold Print** – Indicates a positive result, i.e., levels equal or above regulatory limit (0.050 mg/cm^2; 600 mg/kg) of lead in the surface coating.
LOD – Limit of Detection

Based on the results of the DST's assessment, the following surface coatings were found to contain potentially hazardous levels of lead:

- White paint applied to the door trim found around the entrance to each bedroom and washroom in the main floor hallway of the Subject Building;
- White paint applied to the walls in each bedroom and ensuite washroom of the Subject Building;
- Cream paint applied to the ceiling in the kitchen of the Subject Building.

5.4 Halocarbon and Ozone Depleting Substances (ODSs)

No equipment suspected to contain halocarbon and ozone-depleting substances, including refrigerators, freezers, or air conditioning units, were identified within the Subject Building at the time of the assessment.

5.5 Elemental Mercury

Light fixtures with compact fluorescent bulbs were observed throughout the Subject Building and are known to contain mercury vapor.

Mercury containing equipment was noted to be in GOOD condition at the time of the assessment.

5.6 Polychlorinated Biphenyls (PCBs)

No equipment suspected to contain PCBs were identified within the Subject Building at the time of the assessment.

5.7 Mould Amplification

Mould amplification was identified on the ceiling of the ensuite washroom, located on the main floor of the Subject Building. The mould amounts to approximately 2 feet^2.

According to the previous report by WSP, mould growth was observed at the north wall and ceiling of the master bedroom, the northeast wall at ceiling of the corner bedroom, and north wall at ceiling of the northwest bedroom. Mould was also observed by WSP on the roof sheeting in the attic.

5.8 Crystalline Silica

Sources of crystalline silica and rock dust were identified in the concrete perimeter foundation. The concrete was noted to be in **GOOD** condition, posing a **LOW RISK** of exposure.

5.9 Rodent Droppings

No rodent droppings were observed during the site assessment within the Subject Building.

6.0 RECOMMENDATIONS

6.1 Asbestos-Containing Materials (ACMs)

Prior to any renovation and/or demolition activities, identified ACMs should be removed in accordance with the requirements of the Canada Labour Code, Part II, Public Services and Procurement Canada – Asbestos Management Standard, effective June 5, 2017 and WorkSafeBC, specifically but not limited to include those requirements prescribed through Parts 5.48-5.59 – Controlling Exposure, and Parts 6.1 - 6.32 – Asbestos.

DST recommends reference to WorkSafeBC publication "*Safe Handling of Asbestos, A Manual of Standard Practices"*. This document provides a guide to current practices that are to be followed in the Province of British Columbia, providing basic information on asbestos and asbestos products, health hazards and requirements for worker protection, safe work procedures and principles that should be followed in selecting the most suitable technique for the safe abatement of ACMs.

Asbestos-containing wastes should be managed in accordance with the British Columbia Ministry of Environment and should be transported in accordance with the requirements of the Federal Transportation of Dangerous Goods Act.

6.2 Lead-Based Coatings (LBCs)

DST recommends that LBCs identified to be in poor condition be repaired or removed in accordance with the requirements of WorkSafeBC, namely, the requirements stipulated in the WorkSafeBC Guideline "*Safe Work Practices for Handling Lead*", latest edition.

Control the preparation of painted surfaces in accordance with the requirements of WorkSafeBC, specifically but not limited to include those requirements prescribed in Parts 5.48-5.59 – Controlling Exposure and Parts 6.59-6.69 – Lead of the BC OH&S Regulation. Working in proximity to identified LBCs presents a low risk of exposure. As such, DST would recommend Low Risk safe work procedures for demolition activities that will be conducted in close proximity to identified LBCs.

DST recommends reference to WorkSafeBC publication "*Safe Work Practices for Handling Lead*", latest edition. This manual provides a guide to current practices that are to be followed in the Province of British Columbia, providing basic information on lead and lead products, health hazards and requirements for worker protection, safe work procedures and principles that should be followed in selecting the most suitable technique for the safe abatement of LBCs.

Lead-containing wastes should be disposed of in accordance with the British Columbia Ministry of Environment and should be transported in accordance with the requirements of the Federal Transportation of Dangerous Goods Act.

6.4 Elemental Mercury

When taken out of service, mercury-containing equipment should be managed in accordance with the requirements of the British Columbia Ministry of Environment and should be transported in accordance with the requirements of the Federal Transportation of Dangerous Goods Act.

6.7 Mould Amplification

Based on the findings of this assessment, DST recommends the following:

- Have a qualified remediation contractor remediate identified mould-impacted areas and or moisture elevated building materials. Complete the restoration work in accordance with procedures detailed in WorkSafeBC guideline, entitled *"G4.79 Moulds and Indoor Air Quality Guideline*";
- Have a qualified contractor abate the identified ACMs and LBCs of the identified mould-impacted areas and or moisture elevated building materials in accordance with BC OH&S Regulations and Guidelines;
- Once all remedial work has been completed retain a qualified person to conduct a final clearance inspection of all impacted areas;
- Have a qualified furnace and ducting contractor inspect and clean all ducting and furnace filtration systems.

6.7 Crystalline Silica

Through the course of renovation activities, the concrete building foundation and should be wetted (saturated) with water, prior to, during and upon completion of mechanical renovation activities in an effort to minimize the potential for crystalline silica or rock dust release.

7.0 CLOSING

We hope the information presented in this document meets your current requirements. If you have any questions, or require additional information please contact us at your convenience.

Yours truly,

DST Consulting Engineers Inc.

Report Prepared By:

Aaron Enquist, P.Ag.
Environmental Technologist

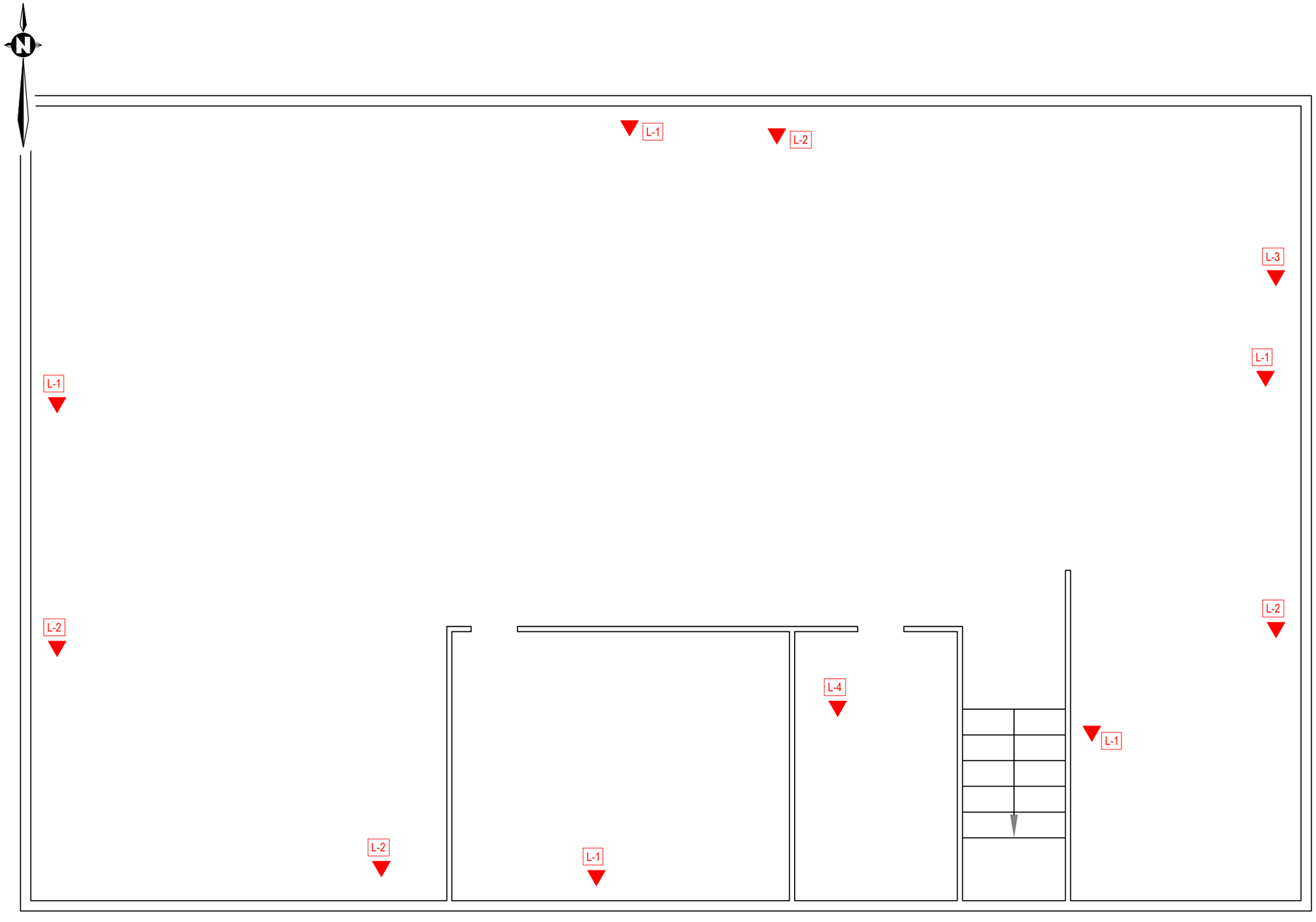
Report Reviewed By:

Christian Injates, CEC, CEM
Associate, Regional Manager

APPENDIX I

FLOOR PLANS

WITH SAMPLE LOCATIONS



Note

1. This drawing shall be read in conjunction with the associated technical report.
2. All drywall joint compound throughout the subject building should be considered asbestos-containing.
3. All ceiling texture coat throughout the subject building should be considered asbestos-containing.
4. Roof sheeting was found to contain mould, ~1,000 sq. ft.

Legend

▼ Approximate lead sample location

Revision	Date	Issue	Approval
0	07/29/19	Original	

Client: **Public Services and Procurement Canada**

Site: **450 Gibson Street, Tofino, BC**

Report Title: **Hazardous Materials Assessment**

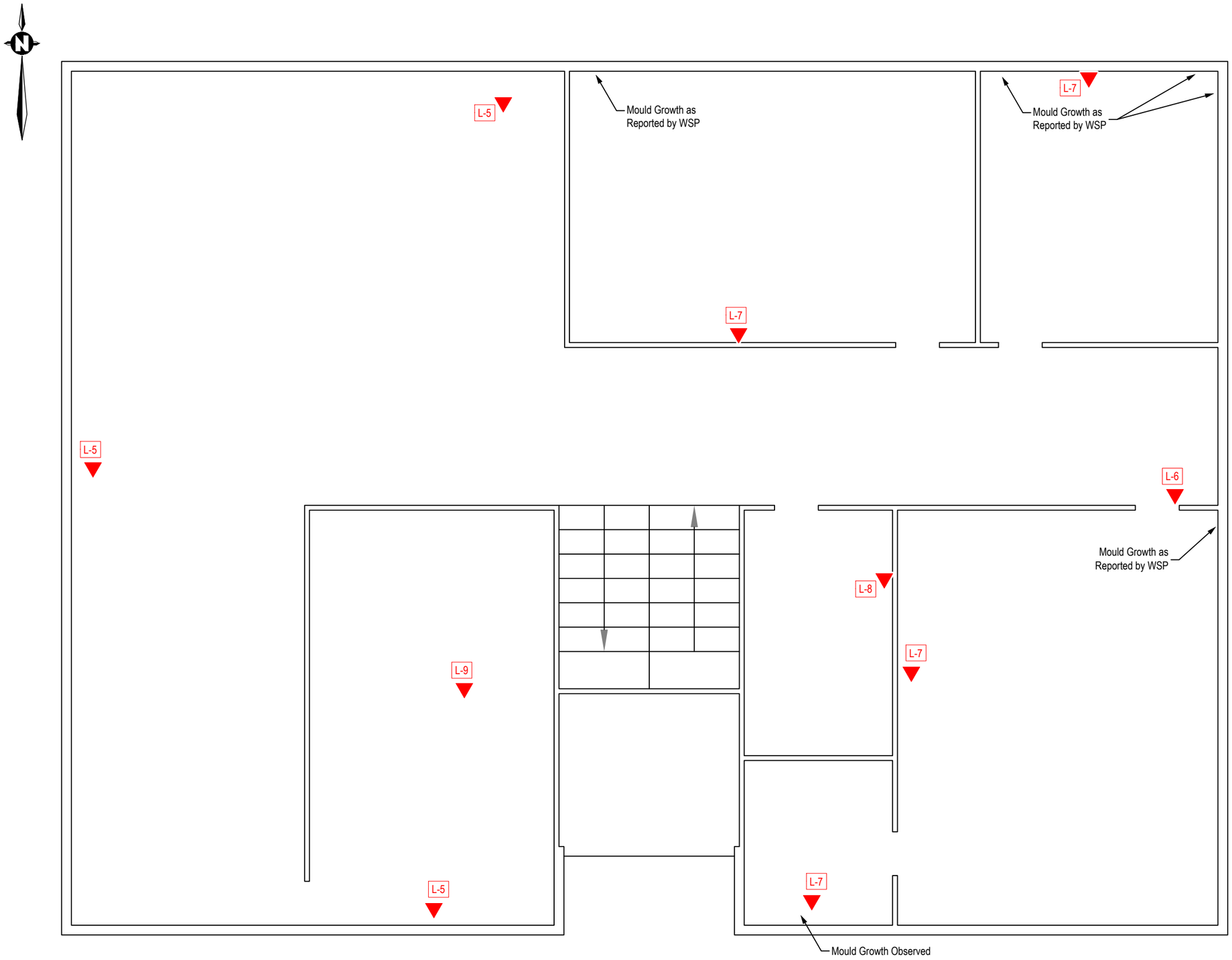
Drawing Title: **Basement Floor Plan**

Designed By: A.E.	Scale: As shown
Drawn By: J.M.	Date: July 2019
Approved By:	Project No.: GV-VC-038570

Figure No.: **1**

Drawing: 1 Basement.dwg Folder: L:\TS\CAD\Projects\GV\GV-VC-038570 Gibson Rd\2019 Hazmat Assessment\DWGs Thursday, July 25, 2019 @ 15:07 by Joven Mendoza

2150 Thurston Drive, Suite 203, Ottawa, Ontario K1G 5T9 Tel: (613) 748-1415 Fax: (613) 748-1356 Website: www.dstgroup.com



DST consulting engineers
a division of Englobe

Note

1. This drawing shall be read in conjunction with the associated technical report.
2. All drywall joint compound throughout the subject building should be considered asbestos-containing.
3. All ceiling texture coat throughout the subject building should be considered asbestos-containing.
4. Roof sheeting was found to contain mould, ~1,000 sq. ft.

Legend

▼ Approximate lead sample location

Revision	Date	Issue	Approval
0	07/29/19	Original	

Client
Public Services and Procurement Canada

Site
450 Gibson Street, Tofino, BC

Report Title
Hazardous Materials Assessment

Drawing Title
Main Floor Plan

Designed By	Scale
A.E.	As shown
Drawn By	**Date**
J.M.	July 2019
Approved By	**Project No.**
	GV-VC-038570

Figure No.
2

2150 Thurston Drive, Suite 203, Ottawa, Ontario K1G 5T9 Tel: (613) 748-1415 Fax: (613) 748-1356 Website: www.dstgroup.com

APPENDIX II

PHOTOGRAPHIC LOG

Photograph 1:

Illustration of lead-containing white paint applied to the trim around the bedroom doors in the main floor hallway of the Subject Building.

Photograph 2:

Illustration of lead-containing white paint applied to the walls in the bedrooms and ensuite washroom on the main floor of the Subject Building.

Photograph 3:

Illustration of lead-containing cream paint applied to the ceiling in the kitchen of the Subject Building.

Photograph 4:

Illustration of mould amplification observed on the ceiling of the ensuite washroom of the Subject Building.

April 18, 2019

Royal Canadian Mounted Police
c/o BGIS Workplace Solutions Inc.
#23-3318 Oak Street
Victoria, BC V8X 1R1

Attention: **Joseph Wale, Service Delivery Leader**

Dear Joseph:

Subject: **Building Name – RCMP Housing, 450 Gibson Street, Tofino BC**
Building Envelope Condition Assessment
Client Ref.: PO#8062040

Per our proposal dated March 21, 2019, we provide the following report.

INTRODUCTION

SCOPE OF WORK

The purpose of our evaluation was to:

- Obtain information on the current condition of the residence at 450 Gibson Street;
- Identify conditions that are or will soon adversely impact performance;
- Identify management strategies; and
- Provide opinions of cost to implement the identified solutions.

PROJECT TEAM

Client

Project Service Lead	Joseph Wale

WSP Canada Inc. (WSP)

Project Technician	Jessica Coburn
Project Manager	Alex McGowan

METHODOLOGY

Work completed for this evaluation included:

The investigation of the building enclosure included a visual review of the interior and exterior, including the roof level and attic space. The review was non-destructive. We took moisture-probe readings at specific interior

locations where organic growth (possibly mould) was reported, in the bedrooms. We reviewed the building drawings that were provided for the proposed mechanical upgrades. This report includes key findings pertaining to current observed conditions, documented with reference photographs. We also provide recommended management strategies and estimated opinions of cost for the recommendations.

Information made available for our review as part of our evaluation was as follows:

DESCRIPTION/TITLE	DATE	AUTHOR
Floor Plans - mechanical	Feb 4, 2019	Rocky Point Engineers
Asbestos Bldg. Material Report	March 14, 2018	Pinchin
Psychrometric Readings	Dec 17, 2018	Acclaim Restorations

GENERAL BUILDING/COMPONENT DESCRIPTION

The building is a two-storey residence located in Tofino. The building is approximately 1750 ft^2 and the date of construction is unconfirmed. The main floor contains the kitchen, bathroom, three bedrooms and living room. The lower level is a partial basement, at ground level along the north and east elevations. The lower level is finished and is mainly used as storage. The foundation is a poured concrete perimeter foundation. The building is clad with vinyl horizontal siding and has double-pane sliding windows throughout. The roof is finished with asphalt shingles. The main heating supply is from electric baseboard heaters located throughout the house. The ventilation is provided by a heat-recovery ventilator (HRV), with four ceiling grilles at the main level of the house.

PERFORMANCE AND HISTORY

The building reportedly had mould growth at the west and south walls of the three bedrooms. The issue became evident to the tenant in the fall of 2018, and since then the mould has been removed and the affected areas repainted. At the time of our site visit, the house had been vacant for two weeks. The heating was turned off, but the HRV was on, and three small dehumidifiers were running.

Our knowledge regarding past repair and restoration work is summarized as follows:

SCOPE OF REPAIR OR RESTORATION	DATE
HRV unit installed	2002 (based on age of unit)
Hazardous Material Review	March, 2018
Interior humidity conditions reviewed	December, 2018
Interior mould remediation at the bedroom walls (as reported by tenant)	January 2019
Mechanical system review and upgrade proposal	February 2019

CURRENT REPAIR PLAN

Based on our discussions with the property management, there are no confirmed repairs planned. The proposed HVAC upgrade is pending.

KEY FINDINGS

1. INADEQUATE SOFFIT VENTILATION: REQUIRES REPAIR

The soffits are not allowing free air flow. **Photo #2** shows the plywood installed above the "vented" soffit panels below (**Photo #3**). There are seven roof vents (**Photo #4**), providing approximately 250 square inches of net free vented air. This meets the minimum requirement of 240 square inches. However, without adequate venting at the soffit, free air flow through the attic is not optimized, and air flow near the eaves is inadequate. Therefore, the attic ventilation requirements are not being met, as the distribution of vents in the attic space does not promote removal of excess moisture.

PHOTO		DESCRIPTION
#1		"Vented" soffit panels at the exterior.
#2		In the attic, plywood is installed above the "vented" soffit panels. Several baffles are not installed far enough down the eave. Therefore, they do not extend past the insulation and are blocked by the insulation. (insulation pulled back for clarity) The soffit is not allowing free air flow. Therefore, the attic ventilation requirements are not being met.

#3		Organic growth at the underside of roof sheathing. Apparent at the south roof pitch.
#4		Venting near the roof ridge is adequate.

2. POSSIBLE ORGANIC GROWTH OCCURRING AT INTERIOR WALLS

The areas that had been reportedly subject to mould growth were examined, and we found reoccurrence of organic growth in two of the three bedrooms. These areas included the west and south walls, as well as the window frames and sills. The interior conditions during our visit were not typical for an occupied house. The heat had been turned off for about two weeks, and three dehumidifiers were running during our visit. That said, moderate levels of moisture in the gypsum can allow mould spores to survive, as the spores remain alive in the paper-facing material and surrounding air. Moisture readings throughout the gypsum walls were between **0.2%-0.5%**. We found signs of

organic growth at the south walls of the two south bedrooms (**Photos 5, 6, 7**) and within the window frames of the three bedrooms (**Photo 8**). If moisture levels at or above 0.5% are sustained over time, and spores are present, mould may continue to thrive, especially if the relative humidity in the space is high in a humid climate. If the moisture content at the surface of the gypsum is 80% or higher (like in closet spaces or behind couches where air circulation is poor) and with temperatures above 5 deg. C, there is a good chance the environment will support mould growth.

PHOTO		DESCRIPTION
#5		Apparent organic growth at the south wall and ceiling of the south-east bedroom. Moisture level readings in this location: **0.5%** (two readings)
#6		Apparent organic growth at the south-east wall and ceiling of the corner bedroom. Moisture level readings in this location: **0.2%, 04%** (two readings)

#7		Possible organic growth at the south-west wall and ceiling of the corner bedroom. Moisture level readings in this location: **0.3%, 0.4%, 05%** (three readings)
#8		There may be viable spores within the window frames that have allowed further cultivation of mould.

3. HVAC: HEAT RECOVERY VENTILATOR MAY BE INADEQUATE

The heat-recovery ventilator (HRV) has been installed to introduce active ventilation in the house. To optimize the function, the HRV must be on at all times. The tenant reported that previous tenants had the HRV grilles closed, and the HRV was not being used continuously until September 2018.

The unit is a VanEE 1001 HRV, and was installed around 2002 (**Photo 9**). There are four ceiling-mounted air exchange grilles at the main level: two in the kitchen, one in the bathroom, and one in the hall. There are no ventilation grilles in the bedrooms. According to the model information, the HRV unit ventilation rate range is 64-146 CFM. We understand that this model has been discontinued, so finding parts for maintenance could be difficult. Furthermore, we understand, through discussions with the tenant, that the HRV drain pipes were contaminated with mould in the fall. These were cleaned during the mould remediation (**Photo 10**). The HRV core, ductwork and filters were not reported to have been cleaned. If the ductwork, filters and HRV core were not cleaned, then they are likely contaminated with mould spores, and continued operation of an HRV that has not been cleaned would recirculate mould spores throughout the building.

PHOTO #		DESCRIPTION
#9		Existing HRV at the southwest end of the basement.
#10		The drainage pipes have been cleaned (reported).

4. OTHER FINDINGS

- While it is unconfirmed that these issues are related to moisture problems within the house, the following building envelope deficiencies were noted on site:
- 1. The carport sits below the two west bedrooms. The underside of the carport has vented soffit material (**Photo 12**), but there is no indication of a ventilation path. There are no visible signs of moisture within the floor joist space; however, if moisture condenses here, it has no path to dry. As we do not know the carport ceiling assembly, we cannot determine if there is potential for moisture accumulation.

– 2. **Photo 11** shows a lack of building paper over the plywood sheathing on the west, contrary to good practice. The plywood shows some signs of wetting at the base of the wall, but it is not evident that the plywood has been wet along the face of the wall or has degraded.

PHOTO #		DESCRIPTION
#11		Roof assembly above the carport is unknown. Lack of ventilation within the joists could allow moisture accumulation.
#12		There is no building paper between the vinyl siding and plywood sheathing.

MANAGEMENT STRATEGIES

TEMPORARY MEASURES

While the existing HRV unit is in use, we recommend cleaning the ductwork and filters to ensure organic material like spores are not being transported around the house through the ventilation system. Once cleaned, the HRV should be on at all times to ensure continuous ventilation, for best indoor air quality.

DO-NOTHING APPROACH

We assume and recommend that measures are taken to manage identified issues. If you choose to do nothing to address the identified issues, risks may include:

- Ongoing and accelerated deterioration that may lead to unsafe environmental (or structural) conditions;
- Risks to occupant health and safety;
- Increased repair and maintenance costs;

INTRODUCE VENTS AT SOFFIT

The attic soffit is currently clad with plywood, leaving no openings for air flow into the attic via the soffits. We recommend increasing the soffit ventilation by removing sections of aluminum panel, cutting sections of plywood to allow air flow, and reinstalling the aluminum soffit panels. Soffit ventilation should be introduced at one square foot of vented free air flow for every 300 square feet of ceiling space.

REMEDIATE ATTIC SPACE

The attic showed evidence of organic growth at the underside of the plywood deck along the south roof pitch. The extent of organic growth within the attic in unconfirmed. The plywood did not appear to be degraded, but there may be contamination of the attic batt insulation. We recommend remediating the interior attic space to eliminate organic growth and the to prevent further cultivation of mould. Determining any damage of the wood components due to moisture or mould was beyond the scope of this report. We assume the space can be remediated without destructive means (replacing framing or roofing material) and our cost estimate reflects this. When the insulation is removed, the continuity of the vapour barrier above the ceiling should also be confirmed. If the vapour barrier is not continuous, it should be made so.

REMEDIATE THE INTERIOR SPACES AND HRV UNIT

There is evidence that the mould spores were not eliminated during the earlier remediation, and moisture levels are allowing a reoccurrence of growth at the bedroom ceilings. This was evident from staining on the ceilings in both south bedrooms. For mould spores to succeed in this environment, it is likely that they are still present from the previous mould remediation. This may be due to spores within the ductwork and HRV core that are being transported throughout the space. We recommend cleaning the interior surfaces where mould may still be thriving, as well as the entire HRV system including the HRV core, ductwork and filters.

ORDER-OF-MAGNITUDE ESTIMATE

The following repair work addresses the above noted issues. The costs are order-of-magnitude estimates only. The presence and extent of mould or organic contamination was not confirmed as it was outside of the scope of this review. The following costs do not consider the possibility of destructive remediation measures.

PROPOSED WORK	ESTIMATED COST
Install ventilation at the soffit panels	**$3,600**
Remediate the attic space	**$7,000**
Remediate at the interior spaces including cleaning ductwork and HRV filters.	**$3,000**
TOTAL ESTIMATE	**$15,600**

FURTHER RECOMMENDATIONS

UPGRADE HRV

We recommend upgrading the active ventilation system. We understand there is a pending HVAC upgrade proposal by Rocky Point Engineering for this building, and that costing will be available from that source. Therefore, we have not included an order-of-magnitude estimate for that work.

INCREASE BUILDING ENVELOPE INSULATION

As a long-term plan, you may consider adding exterior insulation to the building. This will allow an opportunity to review the building envelope components for further deficiencies and introduce a continuous air-barrier membrane. Further, it may improve occupant comfort and reduce heating costs.

We expect this report meets your needs at this time. If you have any questions or concerns, please do not hesitate to contact our office.

Yours sincerely,

Jessica Coburn, MBSc.
Project Associate

Alex McGowan, P. Eng., LEED AP, MBA
Project Manager

Encl. Limitations

Dist: Joseph Wale joseph.wale@bgis.com

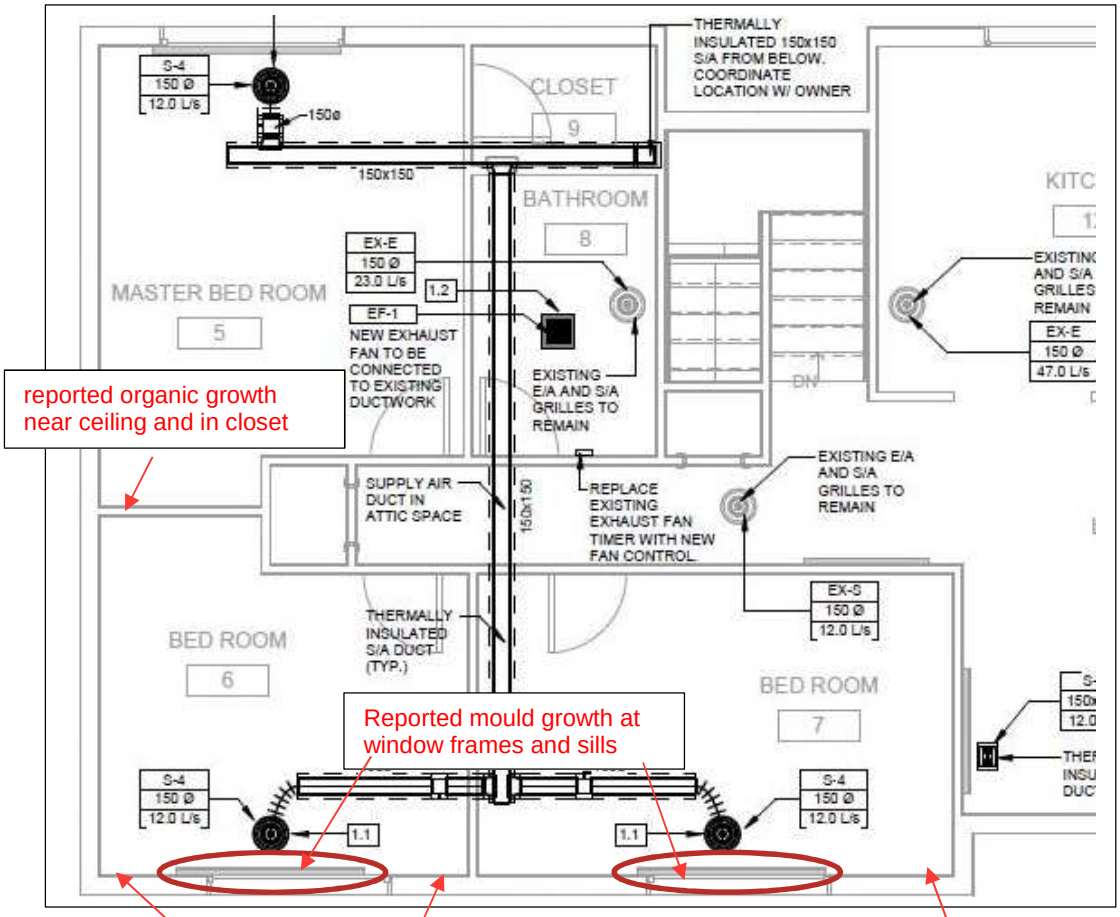
WSP Ref.: 191-04052-00

LIMITATIONS

WSP Canada Inc. is the "Consultant" referenced throughout this document.

- Our scope of work and responsibilities related to this report are defined by the documents that form the agreement and authorization for this work.
- Any user accepts that decisions made or actions taken based upon interpretation of our work are the responsibility of only the parties directly involved in the decisions or actions.
- No party other than the Client shall rely on the Consultant's work without the express written consent of the Consultant, and then only to the extent of the specific terms in that consent. Any use which a third party makes of this work, or any reliance on or decisions made based on it, are the responsibility of such third parties. Any third party user of this report specifically denies any right to any claims, whether in contract, tort and/or any other cause of action in law, against the Consultant (including Sub-Consultants, their officers, agents and employees).The work reflects the Consultant's best judgement in light of the information reviewed by them at the time of preparation. It is not a certification of compliance with past or present regulations. Unless otherwise agreed in writing by the Consultant, it shall not be used to express or imply warranty as to the fitness of the property for a particular purpose. No portion of this report may be used as a separate entity; it is written to be read in its entirety.
- Only the specific information identified has been reviewed. 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. Only conditions actually seen during examination of representative samples can be said to have been appraised and comments on the balance of the conditions are assumptions based upon extrapolation. Therefore, this work does not eliminate uncertainty regarding the potential for existing or future costs, hazards or losses in connection with a property. We can perform further investigation on items of concern if so required.
- The Consultant is not responsible for, or obligated to identify, mistakes or insufficiencies in the information obtained from the various sources, or to verify the accuracy of the information.
- No statements by the Consultant are given as or shall be interpreted as opinions for legal, environmental or health findings. The Consultant is not investigating or providing advice about pollutants, contaminants or hazardous materials.
- The Client and other users of this report expressly deny any right to any claim against the Consultant, including claims arising from personal injury related to pollutants, contaminants or hazardous materials, including but not limited to asbestos, mould, mildew or other fungus.
- Budget figures are our opinion of a probable current dollar value of the work and are provided for approximate budget purposes only. Accurate figures can only be obtained by establishing a scope of work and receiving quotes from suitable contractors.

PARTIAL FLOOR PLAN



reported organic growth near ceiling and in closet

Reported mould growth at window frames and sills

Possible organic growth near ceiling

Possible organic growth near ceiling

N

Drawing credit – Rocky Point Engineering

Asbestos Building Materials Survey Report

Building #E0841

Prepared for:

BGIS - WSI
23-3318 Oak Street
Victoria, BC V8X 1R1

Attention: Diane Mackay, PMP, LEED Green Associate
Acting Regional Director

March 14, 2018

Pinchin File: 0205090.098

MEMBER OF
THE PINCHIN GROUP

Issued to:	**BGIS - WSI**
Contact:	**Diane Mackay, PMP, LEED Green Associate** **Acting Regional Director**
Issued on:	**March 14, 2018**
Pinchin File:	**0205090.098**
Issuing Office:	**Suite 200, 13775 Commerce Parkway,** **Richmond, BC V6V 2V4**
Primary Contact:	**Vanessa McNeil, Director, Hazardous Materials** **604.238.2941**

Author: Raymond Leung, Dipl. OHS
Project Coordinator, Hazardous Materials
604.238.2959
rleung@pinchin.com

Reviewer: Vanessa McNeil, B.A., LEED AP, A.Sc.T., PMP
Director, Hazardous Materials
604.238.2941
vmcneil@pinchin.com

EXECUTIVE SUMMARY

BGIS - WSI (Client) retained Pinchin Ltd. (Pinchin) to conduct an asbestos building materials assessment at Building #E0841. The assessment was performed on February 14, 2018.

The objectives of the assessment were to document the locations of asbestos building materials, evaluate their condition and develop corrective action plans as required for the purposes of long term management. The results of this assessment are not intended for construction, renovation, demolition or project tendering purposes.

SUMMARY OF FINDINGS

Asbestos-containing materials (ACM) are present as follows:

- Drywall and joint compound present on wall and ceiling finishes in the main floor Front Entrance and Stairs, Hallway, Washroom, Southeast Room and Ensuite, Northeast Room, North Room, Living and Dining Room, Kitchen (Loc. 1, 2, 3, 4, 5, 6, 7 & 8).
- Texture-finish present on drywall ceilings in the main floor Front Entrance and Stairs, Hallway, Washroom, Southeast Room and Ensuite, Northeast Room, North Room, Living and Dining Room (Loc. 1, 2, 3, 4, 5, 6, & 7).)

SUMMARY OF RECOMMENDATIONS

The following is a summary of significant recommendations; refer to the body of the report for detailed recommendations:

1. Monitor the condition of asbestos by conducting a re-assessment on a regular basis.
2. Perform a hazardous materials assessment prior to renovation or demolition work.

This Executive Summary is subject to the same standard limitations as contained in the report and must be read in conjunction with the entire report.

TABLE OF CONTENTS

APPENDICES

1.0 INTRODUCTION AND SCOPE

BGIS - WSI (Client) retained Pinchin Ltd. (Pinchin) to conduct an asbestos building materials assessment at Building #E0841.

The assessment was performed by Raymond Leung, Dipl. OHS, Project Coordinator, on February 14, 2018. The surveyor was unaccompanied during the assessment. The building was occupied at the time of the assessment.

The objectives of the assessment were to document the locations of asbestos building materials, evaluate their condition and develop corrective action plans as required. This assessment is only to be used for the purposes of long term management and routine maintenance. The results of this assessment are not to be used for construction, renovation, demolition or project tendering purposes.

1.1 Scope of Assessment

The assessment was performed to establish the location and type of asbestos building materials incorporated in the structure(s) and its finishes. The assessed area consisted of all interior parts of the building.

2.0 BACKGROUND INFORMATION

2.1 Building Description

Item	Details
Building Use	RCMP Employee Housing
Number of Floors/Levels	One storey plus one below grade
Total Area of Building	2138 square feet
Year of Construction	1973
Structure	Wood framed, concrete slab
Exterior Cladding	Vinyl siding
HVAC	Forced Air, electrical baseboard
Roof	Asphalt shingles
Flooring	Vinyl sheet flooring, wood laminate, concrete
Interior Walls	Drywall

Item	Details
Ceilings	Drywall, texture finish, acoustic ceiling tile

2.2 Existing Reports

No existing reports were provided for reference.

3.0 FINDINGS

The following section summarizes the findings of the assessment and provides a general description of the asbestos materials identified and their locations. For details on quantities, assessment and locations of asbestos materials; refer to the Summary Report and All Data Report in Appendix V and VI.

3.1 Suspect Building Materials Not Found

The following types of building materials may historically contain asbestos but were not observed in the assessed area and are not discussed in the report findings:

- Spray-on fireproofing or thermal insulation
- Thermal systems insulation
- Plaster
- Asbestos cement products (e.g. Transite)
- Vinyl floor tiles and mastic

3.2 Texture Finishes (Acoustic/Decorative)

Texture finish, containing chrysotile asbestos, is present on drywall ceilings in the Front Entrance and Stairs, Hallway, Washroom, Southeast Room and Ensuite, Northeast Room, North Room and Living and Dining Room (Loc.1, 2, 3, 4, 5, 6, 7) (samples S0002A-E). There is approximately 1050 square feet of texture finish. Texture finish is friable, is in good condition and is painted.

3.3 Pipe Insulation

Pipes present in the assessed area are uninsulated.

3.4 Duct Insulation

Ducts present in the assessed area are uninsulated.

3.5 Mechanical Equipment Insulation

Mechanical equipment is either uninsulated or insulated with non-asbestos fibreglass.

3.6 Drywall Joint Compound

Drywall joint compound (S0001A-E), containing chrysotile asbestos, is present on wall finishes in the main floor Front Entrance and Stairs, Hallway, Washroom, Southeast Room and Ensuite, Northeast Room, North Room, Living and Dining Room, Kitchen (Loc. 1, 2, 3, 4, 5, 6, 7 & 8). Drywall joint compound is a non-friable material, painted and is in good condition.

Drywall joint compound present on walls throughout the basement floor does not contain asbestos (S0005A-C).

3.7 Vinyl Sheet Flooring

Vinyl sheet flooring is present as follows:

Pattern, Colour and Photo Number	Paper Backing (Yes/No)	Locations (Quantity)	Sample Number	Asbestos Type
Beige Squared	Yes	Front Entrance and Stairs(Loc.1), Washroom (Loc.3), Southeast Room and Ensuite (Loc.4), Kitchen (Loc.8)	S0003	Non Detected

3.8 Acoustic Ceiling Tiles

Acoustic ceiling tile are present in the assessed area, as follows:

Size, Type, Pattern, Photo #	Locations (Quantity in Square Feet)	Sample Number or Date Code	Asbestos Type
2’ x4’ Lay in, pinhole	Stairs and Hallway (Loc.9), Laundry and Side Entrance (Loc.10), Recreational Area and Gym (Loc.12), South Room (Loc.13)	S0004A-C	None Detected

3.9 Vermiculite

Loose fill vermiculite debris was not observed in the attic space or areas inspected. Destructive testing was not performed and vermiculite may be present in void spaces within wood framed walls and other void spaces however this was not observed during the assessment.

3.10 Presumed Asbestos Materials

A number of materials which might contain asbestos were not sampled during this assessment due to limitations in scope and methodology. Where present, these materials are presumed to contain asbestos until otherwise proven by sampling and analysis.

Materials presumed to contain asbestos include:

- Roofing, felts and tar
- Caulking
- Soffit and fascia boards

4.0 RECOMMENDATIONS

4.1 General

Monitor the condition of asbestos by conducting a re-assessment on a regular basis.

Before undertaking any work activity that may potentially impact an ACM, implement an Exposure Control Plan which includes classification of the work activity (low, moderate, high), labelling, control of friable asbestos, implementation of safe work procedures and development of an employee education program.

Prior to conducting building renovation or demolition operations, perform a hazardous materials assessment. The assessment should include destructive testing (i.e. coring and/or removal of building finishes and components), and sampling of other hazardous materials (lead, mercury, PCB, mould, etc.) and materials not tested for asbestos in this study (e.g. roofing materials, caulking, mastics).

5.0 TERMS AND LIMITATIONS

This work was performed subject to the Terms and Limitations presented or referenced in the proposal for this project.

Information provided by Pinchin is intended for Client use only. Pinchin will not provide results or information to any party unless disclosure by Pinchin is required by law. Any use by a third party of reports or documents authored by Pinchin or any reliance by a third party on or decisions made by a third party based on the findings described in said documents, is the sole responsibility of such third parties. Pinchin accepts no responsibility for damages suffered by any third party as a result of decisions made or actions conducted. No other warranties are implied or expressed.

6.0 REFERENCES

The following legislation and documents were referenced in completing the assessment and this report:

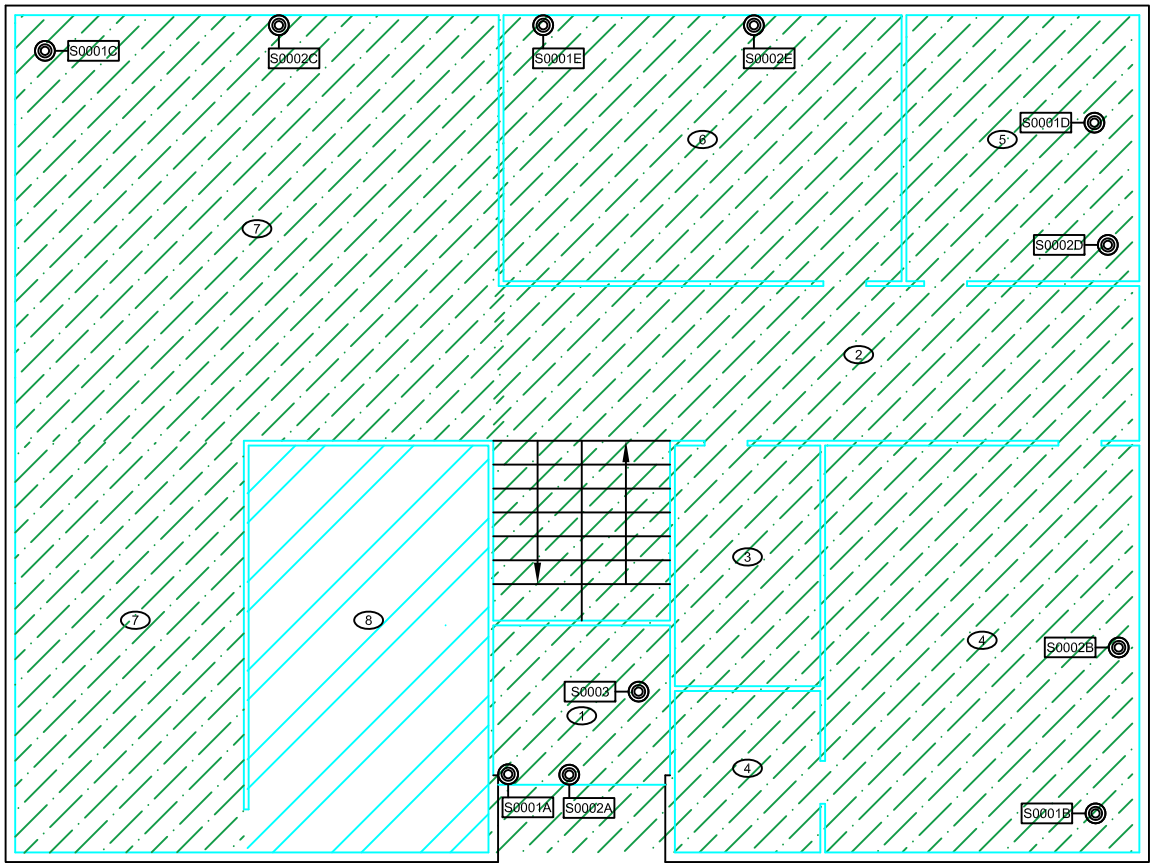
1. Canada Occupational Health and Safety Regulations, Canada Labour Code, SOR/2017-132.
2. Occupational Health and Safety Regulation, B.C. Reg. 296/97, WorkSafe BC.
3. Safe Work Practices for Handling Asbestos, WorkSafe BC, 2017 Edition.
4. Hazardous Waste Regulation, B.C. Reg. 261/2006, BC Ministry of Environment.
5. Transportation of Dangerous Goods Regulations SOR/2008-34, Transportation of Dangerous Goods Act.

Template: Master Report for Asbestos Assessment, Haz, September 14, 2017

J:\205000s\0205090.000 BGIS-WSI,2619StumLakeRd,HAZ,HazAbatement\0205090.098 BGIS-WSI,MulitpleRCMP,HAZ,Tofino\Deliverables\E0841\205090.098_RCMP_E0841_Asbestos Bldg Materials Survey Report_BGIS WSI.docx

APPENDIX I

Drawings



NOTES:
1. ALL DRAWINGS TO BE REFERENCED WITH THE HAZARDOUS MATERIALS ASSESSMENT REPORT. NOT ALL KNOWN OR SUSPECT HAZARDOUS MATERIALS ARE DEPICTED ON THIS DRAWING. REFER TO THE HAZARDOUS MATERIALS ASSESSMENT REPORT FOR A COMPLETE LIST OF IDENTIFIED HAZARDOUS MATERIALS.
2. BASEPLAN PROVIDED BY THE CLIENT.
3. LEGEND IS COLOUR DEPENDENT, PHOTOCOPIES MAY ALTER INTERPRETATION OF FIGURE.

PINCHIN

LEGEND:
- (X) LOCATION NUMBER
- ASBESTOS BULK SAMPLE LOCATION
- ASBESTOS-CONTAINING MATERIALS:
- JOINT COMPOUND ON CEILING
- JOINT COMPOUND ON WALL
- TEXTURE FINISH

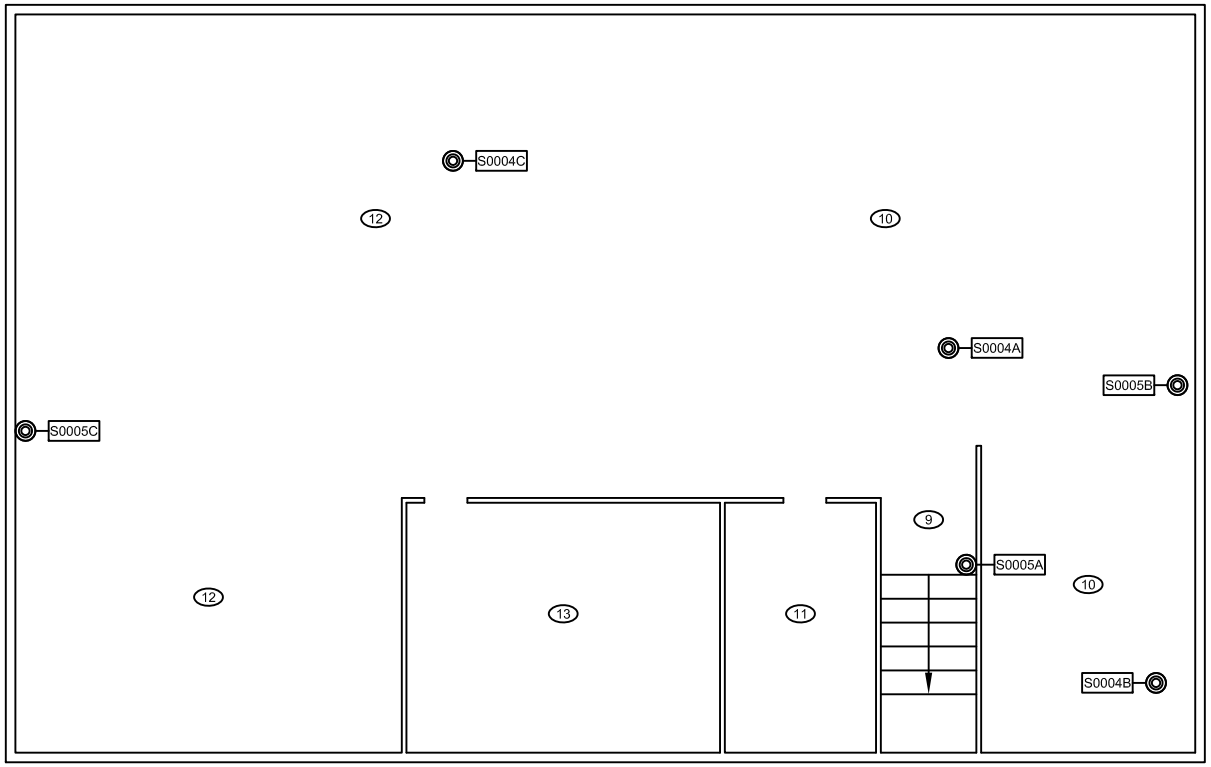
CLIENT:
BGIS WSI
23-3318 OAK STREET
VICTORIA, BC V8X 1R1

LOCATION:
E0841

TITLE:
ASBESTOS MANAGEMENT ASSESSMENT
MAIN FLOOR

DATE:	PROJECT # :
2018/02/24	205090.098
DRAWN BY: PK	DRAWING: 1 OF 2
CHECKED BY: AR	
SCALE: NTS	

PA2018020564



NOTES:
1. ALL DRAWINGS TO BE REFERENCED WITH THE HAZARDOUS MATERIALS ASSESSMENT REPORT. NOT ALL KNOWN OR SUSPECT HAZARDOUS MATERIALS ARE DEPICTED ON THIS DRAWING. REFER TO THE HAZARDOUS MATERIALS ASSESSMENT REPORT FOR A COMPLETE LIST OF IDENTIFIED HAZARDOUS MATERIALS.
2. BASEPLAN PROVIDED BY THE CLIENT.
3. LEGEND IS COLOUR DEPENDENT, PHOTOCOPIES MAY ALTER INTERPRETATION OF FIGURE.

PINCHIN

LEGEND:
- (X) LOCATION NUMBER
- ASBESTOS BULK SAMPLE LOCATION

CLIENT:
BGIS WSI
23-3318 OAK STREET
VICTORIA, BC V8X 1R1

LOCATION:
E0841

TITLE:
ASBESTOS MANAGEMENT
ASSESSMENT
BASEMENT

DATE:	PROJECT # :
2018/02/24	205090.098
DRAWN BY: PK	DRAWING: 2 OF 2
CHECKED BY: AR	
SCALE: NTS	

PA2018020565

APPENDIX II

Asbestos Analytical Certificates

Bulk Asbestos Analysis

By Polarized Light Microscopy
EPA Method: 600/R-93/116 and 600/M4-82-020

NVLAP Lab Code: 200664-0

Customer: Pinchin Ltd.
Suite 200, 13775 Commerce Parkway
Richmond, BC V6V 2V4

Attn: Aurea Roberson
Raymond Leung

Project: 205090.098 E0841

Lab Order ID: 11804152
Analysis ID: 11804152_PLM
Date Received: 2/19/2018
Date Reported: 2/27/2018

Sample ID *Lab Sample ID*	Description *Lab Notes*	Asbestos	Fibrous Components	Non-Fibrous Components	Attributes Treatment
S0001A *11804152PLM_1*	Drywall And Joint Compound,Loc:1,Front Entrance And Stairs	**2% Chrysotile**		**98% Other**	White Non Fibrous Homogeneous Crushed
S0001B *11804152PLM_2*	Drywall And Joint Compound,Loc:4,Southeast Room And Ensuite	**Not Analyzed**			
S0001C *11804152PLM_3*	Drywall And Joint Compound,Loc:7,Living And Dining Room	**Not Analyzed**			
S0001D *11804152PLM_4*	Drywall And Joint Compound,Loc:5,Northeast Room	**Not Analyzed**			
S0001E *11804152PLM_5*	Drywall And Joint Compound,Loc:6,North Room	**Not Analyzed**			
S0002A *11804152PLM_6*	Texture Coat,Loc:1,Front Entrance And Stairs	**3% Chrysotile**		**97% Other**	White Non Fibrous Homogeneous Crushed
S0002B *11804152PLM_7*	Texture Coat,Loc:4,Southeast Room And Ensuite	**Not Analyzed**			
S0002C *11804152PLM_8*	Texture Coat,Loc:7,Living And Dining Room	**Not Analyzed**			

Bethany Nichols (18)

Analyst

Approved Signatory

Bulk Asbestos Analysis

By Polarized Light Microscopy
EPA Method: 600/R-93/116 and 600/M4-82-020

NVLAP Lab Code: 200664-0

Customer: Pinchin Ltd.
Suite 200, 13775 Commerce Parkway
Richmond, BC V6V 2V4

Attn: Aurea Roberson
Raymond Leung

Project: 205090.098 E0841

Lab Order ID: 11804152
Analysis ID: 11804152_PLM
Date Received: 2/19/2018
Date Reported: 2/27/2018

Sample ID *Lab Sample ID*	Description *Lab Notes*	Asbestos	Fibrous Components	Non-Fibrous Components	Attributes Treatment
S0002D *11804152PLM_9*	Texture Coat,Loc:5,Northeast Room	**Not Analyzed**			
S0002E *11804152PLM_10*	Texture Coat,Loc:6,North Room	**Not Analyzed**			
S0003 - A *11804152PLM_11*	Vinyl Sheet Flooring (with Backi,Beige Squares,Loc:1,Front Entrance *backing*	**None Detected**	**50% Cellulose** **10% Fiber Glass**	**40% Other**	Gray Fibrous Homogeneous Ashed, Teased
S0003 - B *11804152PLM_18*	Vinyl Sheet Flooring (with Backi,Beige Squares,Loc:1,Front Entrance *mastic/leveling*	**None Detected**		**100% Other**	Gray, Yellow Non Fibrous Heterogeneous Dissolved
S0004A *11804152PLM_12*	Lay-in Ceiling Tiles,Loc:9,Stairs And Hallway	**None Detected**	**40% Cellulose** **40% Fiber Glass**	**10% Perlite** **10% Other**	White, Gray Fibrous Homogeneous Ashed, Teased
S0004B *11804152PLM_13*	Lay-in Ceiling Tiles,Loc:10,Laundry And Side Entrance	**None Detected**	**40% Cellulose** **40% Fiber Glass**	**10% Perlite** **10% Other**	White, Gray Fibrous Homogeneous Ashed, Teased
S0004C *11804152PLM_14*	Lay-in Ceiling Tiles,Loc:12,Recreational Area And Gym	**None Detected**	**40% Cellulose** **40% Fiber Glass**	**10% Perlite** **10% Other**	White, Gray Fibrous Homogeneous Ashed, Teased
S0005A *11804152PLM_15*	Drywall And Joint Compound,Loc:9,Stairs And Hallway	**None Detected**		**100% Other**	White Non Fibrous Homogeneous Crushed

Disclaimer: Due to the nature of the EPA 600 method, asbestos may not be detected in samples containing low levels of asbestos. We strongly recommend that analysis of floor tiles, vermiculite, and/or heterogeneous soil samples be conducted by TEM for confirmation of "None Detected" by PLM. This report relates only to the samples tested and may not be reproduced, except in full, without the written approval of SAI. This report may not be used by the client to claim product endorsement by NVLAP or any other agency of the U.S. government. Analytical uncertainty available upon request. Scientific Analytical Institute participates in the NVLAP Proficiency Testing program. Unless otherwise noted blank sample correction was not performed. Estimated MDL is 0.1%.

Bethany Nichols (18)

Analyst

Approved Signatory

Bulk Asbestos Analysis

By Polarized Light Microscopy
EPA Method: 600/R-93/116 and 600/M4-82-020

NVLAP Lab Code: 200664-0

Customer: Pinchin Ltd.
Suite 200, 13775 Commerce Parkway
Richmond, BC V6V 2V4

Attn: Aurea Roberson
Raymond Leung

Project: 205090.098 E0841

Lab Order ID: 11804152
Analysis ID: 11804152_PLM
Date Received: 2/19/2018
Date Reported: 2/27/2018

Sample ID *Lab Sample ID*	Description *Lab Notes*	Asbestos	Fibrous Components	Non-Fibrous Components	Attributes Treatment
S0005B *11804152PLM_16*	Drywall And Joint Compound,Loc:10,Laundry And Side Entrance	**None Detected**		**100% Other**	White Non Fibrous Homogeneous Crushed
S0005C *11804152PLM_17*	Drywall And Joint Compound,Loc:12,Recreational Area And Gym	**None Detected**		**100% Other**	White Non Fibrous Homogeneous Crushed

Bethany Nichols (18)

Analyst

Approved Signatory

1180415Z

Version 1-15-2012

Client:	Pinchin Ltd.	***Instructions:***	
Contact:	Aurea Roberson Raymond Leung	*Use Column "B" for your contact info*	
Address:	200-13775 Commerce Parkway Richmond, BC V6V 2V4	*To See an Example Click the bottom Example Tab.*	
Phone:	604-238-2944		
Fax:	604-244-8491		
Email:	aroberson@pinchin.com rleung@pinchin.com	***20***	
Project:	205090.098 E0841	***Begin Samples with a "<< "above the first sample and end with a ">>" below the last sample.*** *Only Enter your data on the first sheet "Sheet1"*	
Client Notes:	Stop positive on all samples. Perform ashing on THIRD vinyl floor tile if first two are ND. Sample floor mastic on FIRST vinyl floor tile in the set only.	*Note: Data 1 and Data 2 are optional fields that do not show up on the official*	
P.O. #.	205090.098		
Date Submitted:	2/16/2018 0:00		
Analysis:	PLM BULK EPA 600	*report, however they will be included in the electronic data returned to you*	
TurnAroundTime:	6+ Days	*to facilitate your reintegration of the report data.*	

Scientific Analytical Institute

4604 Dundas Dr. Greensboro, NC 27407

Phone: 336.292.3888
Fax: 336.292.3313
Email: lab@sailab.com

Sample Number	Data 1 (Lab use only)	Sample Description	Data 2 (Lab use only)
<<			
S0001A		Drywall And Joint Compound,Loc:1,Front Entrance And Stairs	
S0001B		Drywall And Joint Compound,Loc:4,Southeast Room And Ensuite	
S0001C		Drywall And Joint Compound,Loc:7,Living And Dining Room	
S0001D		Drywall And Joint Compound,Loc:5,Northeast Room	
S0001E		Drywall And Joint Compound,Loc:6,North Room	
S0002A		Texture Coat,Loc:1,Front Entrance And Stairs	
S0002B		Texture Coat,Loc:4,Southeast Room And Ensuite	
S0002C		Texture Coat,Loc:7,Living And Dining Room	
S0002D		Texture Coat,Loc:5,Northeast Room	
S0002E		Texture Coat,Loc:6,North Room	
S0003		Vinyl Sheet Flooring (with Backi,Beige Squares,Loc:1,Front Entrance And Stairs	
S0004A		Lay-in Ceiling Tiles,Loc:9,Stairs And Hallway	
S0004B		Lay-in Ceiling Tiles,Loc:10,Laundry And Side Entrance	
S0004C		Lay-in Ceiling Tiles,Loc:12,Recreational Area And Gym	
S0005A		Drywall And Joint Compound,Loc:9,Stairs And Hallway	
S0005B		Drywall And Joint Compound,Loc:10,Laundry And Side Entrance	
S0005C		Drywall And Joint Compound,Loc:12,Recreational Area And Gym	
>>			

Accepted ☑

Rejected ☐

K. Hamlin

2/19/18

10:36AM

APPENDIX III-A
Methodology

1.0 GENERAL

Pinchin conducts a room-by-room survey (rooms, corridors, service areas, exterior, etc.) to identify the asbestos building materials defined by the scope of the work. All work is conducted in accordance with our own internal Standard Operating Procedures.

Information regarding the location and condition of asbestos building materials encountered and visually estimated quantities are recorded. The locations of any samples collected are recorded on small-scale plans.

As-built drawings and previous reports are referenced where provided.

1.1 Scope Limitations

The assessment excludes the following:

- Articles belonging to the owner, tenant or occupant (e.g. stored items, furniture, appliances, etc.);
- Underground materials or equipment (e.g. vessels, drums, underground storage tanks, pipes, etc.);
- Building envelope, structural components, inaccessible or concealed materials or other items where sampling may cause consequential damage to the property.
- Energized systems (e.g. internal boiler components, elevators, mechanical or electrical components);
- Controlled products (e.g. stored chemicals, operational or process-related substances); and
- Materials not typically associated with construction (e.g. settled dust, spills, residual contamination from prior spills, etc.).

The assessment is limited to non-intrusive testing. Concealed spaces such as those above solid ceilings and within shafts and pipe chases are accessed via existing access panels only Pinchin does not conduct demolition of walls, solid ceilings, structural items, interior finishes or exterior building finishes, to determine the presence of concealed materials.

1.2 Detailed Methodology

Pinchin conducts an inspection for the presence of friable and non-friable asbestos-containing materials (ACM). A friable material is a material that when dry can be crumbled, pulverized or powdered by hand pressure.

A separate set of samples is collected of each type of homogenous material suspected to contain asbestos. A homogenous material is defined by the US EPA as 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 homogeneous materials are determined by visual examination and available information on the phases of construction and prior renovations.

Pinchin collects samples at a rate that is in compliance with the requirements of local regulations and guidelines.

The sampling strategy is also based on known ban dates and phase out dates of the use of asbestos; sampling of certain building materials is not conducted after specific construction dates. In addition, to be conservative, several years past these dates are added to account for some uncertainty in the exact start/finish date of construction and associated usage of ACM.

In some cases, manufactured products such as asbestos cement pipe are visually identified without sample confirmation.

Drywall joint compound is sampled at exterior walls, columns or other locations that are unlikely to have been renovated in an attempt to determine the presence of asbestos in the original drywall compound. Delineation of asbestos-containing drywall compound from newer, non-asbestos drywall compound is not conducted.

Flooring mastic or adhesive is sampled and analyzed if present on the underside of flooring samples (vinyl floor tile and vinyl sheet flooring).

If present, the following materials are presumed to be asbestos-containing and are best sampled immediately prior to commencing renovation/disturbance:

- concrete floor levelling compound
- elevator and lift brakes
- electrical components or wiring within control centers, breakers, motors or lights, insulation on wiring
- refractory materials and insulations in boilers, incinerators and stacks
- insulation under metal clad boilers and vessels
- vermiculite in concrete block wall cavities
- adhesives and duct mastics
- caulking
- fibre reinforced paints and coatings
- paper products under wood flooring

- soffit and fascia boards at elevated heights
- mechanical packing, ropes and gaskets
- fire resistant doors or metal clad finishes

Pinchin submits the bulk samples to a NVLAP accredited laboratory for analysis. The analysis is performed in accordance with Test Method EPA/600/R-93/116: Method for the Determination of Asbestos in Bulk Building Materials, July 1993.

In British Columbia an ACM is defined as materials containing 0.5% asbestos by weight, or any amount of asbestos for vermiculite insulation.

The asbestos analysis is completed using a stop positive approach. Only one result meeting the above regulated criteria is required to determine that a material is asbestos-containing, but all samples must be analyzed to conclusively determine that a material is non-asbestos. The laboratory stops analyzing samples from a homogeneous material once a result equal to or greater than the regulated criteria is detected in any of the samples of that material. All samples of a homogeneous material are analyzed if no asbestos is detected. In some cases, all samples are analyzed in the sample set regardless of result. Where building materials are described in the report as non-asbestos, this means that either no asbestos was detected by the analytical method utilized in any of the multiple samples or, if detected, it is below the lower limit of an asbestos-containing material in the applicable regulation.

Asbestos materials are evaluated in order to make recommendations regarding remedial work. The priority for remedial action is based on several factors:

- Friability (friable or non-friable).
- Condition (good, fair, poor, debris).
- Accessibility (ranking from accessible to all building users to inaccessible).
- Visibility (whether the material is obscured by other building components).
- Air movement or air erosion (present, not present).
- Efficiency of the work (for example, if damaged ACM is being removed in an area, it may be most practical to remove all ACM in the area even if it is in good condition).

For a complete description of the Evaluation Criteria and Basis of Recommendations, refer to Annex A.

Master Template: Methodology Document for Asbestos Assessment, HAZ, July 21, 2017

APPENDIX III-B

Methodology Annex A

1.0 EVALUATION CRITERIA AND BASIS OF RECOMMENDATIONS

The detailed asbestos assessment provides information regarding the location, condition, accessibility and friability of the asbestos-containing materials (ACM). In order to make recommendations for compliance with current regulations, Pinchin developed the following criteria.

2.0 EVALUATION OF CONDITION

2.1 Friable Sprayed or Trowelled Fireproofing, Thermal Insulation and Texture Finishes (Surfacing Materials)

To evaluate the condition of ACM sprayed or trowelled on fireproofing, sprayed or trowelled thermal insulation (non-mechanical), or texture, decorative or acoustic finishes, the following criteria are applied:

Good	Surface of material shows no significant signs of damage, deterioration or delamination. Good condition includes unencapsulated or unpainted fireproofing or texture finishes, where no or limited delamination or damage is observed, or encapsulated fireproofing or texture finishes where the encapsulant or paint has been applied after the damage or fallout occurred.
Poor	A sprayed material that shows signs of significant damage or is significantly delaminating or deteriorating. This may be limited to surface delamination or some portion of the substrate may be exposed.

In locations where damage exists in isolated areas, both good and poor condition may be applicable. The extent of each condition will be recorded. Fair condition is not utilized in the evaluation of ACM sprayed or trowelled fireproofing, sprayed or trowelled thermal insulation (non-mechanical), or texture, decorative or acoustic finishes.

The evaluation of the above products above ceilings may be limited by the number of observations and by building components such as ducts or full height walls that obstruct the above ceiling observations.

2.2 Friable Mechanical or Thermal System Insulation (TSI)

To evaluate the condition of mechanical insulation on vessels, boilers, breeching, ducts, pipes, fan units, equipment etc. the following criteria are applied:

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 damage (i.e. scuffs or stains), but the jacketing is not penetrated.
Fair	Minor penetrating 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 from minor to none. Damage can be repaired.

Poor	Original insulation jacket is missing, damaged, deteriorated or delaminated. Insulation is exposed and significant areas have been dislodged. Damage cannot be readily repaired. Includes components where insulation may have been removed incompletely.

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. It is often not possible to observe each foot of mechanical insulation from all angles.

2.3 Potentially Friable Materials and Miscellaneous Friable Materials

Potentially friable ACM are products that are basically non-friable while in place, but have the potential to generate friable dust upon removal or if significantly disturbed without appropriate procedures. These products may become friable but may become friable if damaged. Potentially friable materials include materials such as acoustic ceiling tiles and plaster. To evaluate the condition of potentially friable materials, the following criteria are applied:

Good	No significant damage or deterioration. Still serving its intended use as a building material or finish.
Fair	Showing signs of some cracking or breakage, but is not deteriorating (e.g. cracked plaster, broken but in place ceiling tile, missing tile or section of plaster etc.). The condition is such that it is still serving its intended use as a building material or finish but may require repair for mainly cosmetic purposes.
Poor	Significant deterioration or breaking apart of the material. Material has deteriorated to the point it is not serving its intended use as building material or finish. Material has deteriorated to a point it has become friable. Normally potentially friable ACM in Poor condition is not repairable and requires at least localized removal and replacement.

2.4 Non-Friable Materials

Non-friable ACM cover a wide range of products with a wide variation in their tendency to release dust or asbestos fibres to the air. Many of these materials, (particularly where the matrix is an unweathered bitumen, asphalt or tar material) do not release fibres except in very unusual circumstances or during significant disturbance (e.g. use of abrasive power tools). Others with a cementitious matrix (asbestos-cement products) can more readily release dust due to abrasion, demolition, weathering, etc. The potential for asbestos release from non-friable ACM is always lower than from friable ACM. To evaluate the condition of non-friable Materials, the following criteria are applied:

Good	No significant damage or deterioration. Still serving its intended use as a building material or finish.

Fair	Showing signs of some cracking or breakage, but is not deteriorating (e.g. cracked vinyl floor tile, missing piece of tile or transite, etc.). The condition is such that it is still serving its intended use as a building material or finish but may require repair for mainly cosmetic purposes.
Poor	Significant deterioration or breaking apart of the material to the point at which it cannot be repaired and it will require at least local removal. Material has deteriorated to the point it is not serving its intended use as building material or finish. Material may have deteriorated to a point where traffic or disturbance may cause it to become friable.

2.5 Evaluation of ACM Debris

The identification of the exact location or presence of debris on the top of ceiling tiles is limited by the number of observations made and the presence of building components such as ducts or full height walls that obstruct observations.

The presence of fallen or dislodged ACM is noted separately from the ACM source and is referred to as Debris. Debris may be friable if from a friable ACM source or a badly deteriorated non-friable ACM source. Debris may also be non-friable (such as fallen pieces of transite sheet or mastic fittings, or broken, dislodged floor tiles).

Debris	Debris may be friable or non-friable, but is always identified as debris.

2.6 Evaluation of Presumed Asbestos-Containing Material (PACM)

Presumed asbestos-containing materials (PACM), are building materials that may contain asbestos but were not sampled or analyzed due to inaccessibility or the need to perform destructive testing to obtain a reasonable sample set. Evaluation of these materials is based on the assumption that these PACM are asbestos-containing.

A list of PACM is provided in the report and they are generally not included in the detailed room by room reports. Typically they are excluded because they are inaccessible or present in very small quantities. If PACM are evaluated, Pinchin uses the criteria that correspond with the type (and friability) of the material listed above.

3.0 EVALUATION OF ACCESSIBILITY

The accessibility of building materials known or suspected of being ACM is rated according to the following criteria:

Access (A)	Common areas of the building within reach of all building users (approximately 8 '-9' from floor or standard ceiling height). Includes other areas where occupant activities may result in disturbance of material that is not normally within reach from floor level, but may be disturbed by common activities (e.g. gymnasiums, workshops, warehouses)
Access (B)	Areas of the building accessed primarily by Maintenance/Caretaking/Janitorial Staff and within reach without use of a ladder. Includes areas within reach in Boiler Rooms, Electrical Rooms, Janitors Closets, Elevator Rooms, Mechanical Rooms, etc. Includes materials within reach from fixed ladders or catwalks, mezzanines, and accessible pipe chases.
Access (C) and Visible	Areas of the building above 8' - 9' where use of a ladder or scaffold is required to reach the ACM. Only includes ACM that are visible to view without the removal or opening of other building components such as ceiling tiles or service access panels. Visible column on HMIS sheets will say YES.
Access (C) and not Visible	Areas of the building above 8' - 9' where use of a ladder or scaffold is required to reach the ACM. Includes ACM that are not visible to view and require the removal of a building component to see, such as ceilings tiles or access panels to view and access. Includes rarely entered crawl spaces, attic spaces, etc. Observations will be limited to the extent visible from the access points. Visible column on HMIS sheets will say NO.
Access (D)	Areas of the building behind inaccessible solid ceiling systems, walls or equipment etc. where demolition of the ceiling, wall or equipment etc. is required to reach the ACM. Material inaccessible due to height or location or is only accessed under unusual situations. Evaluation of condition and extent of ACM is limited or impossible, depending on the surveyor's ability to visually examine materials in Access D.

4.0 AIR EROSION, AIR PLENUM OR AIR MOVEMENT

The presence of possible air erosion in an air plenum or from air movement is recorded as follows:

Yes / No	The ACM is in a return air plenum or in a direct airstream or there is evidence of air erosion (i.e. duct for heating or cooling blowing directly on or across an ACM).

5.0 ACTION MATRIX AND DEFINITIONS

Pinchin's evaluation of the viability of a specific asbestos control option is based on the consideration of the friability, condition, accessibility and visibility of a material. The logic used is that damaged ACM located in an area frequently accessed by all building occupants is of a higher priority than damaged ACM located in an infrequently accessed service area. The action matrix considers the potential for fibre release (primarily from friable ACM) and the possible concerns from regulatory bodies and many building occupants to all damaged ACM (including non-friable).

In any building with asbestos, many current regulations require an Asbestos Management Program be implemented. Depending on the condition and the accessibility, more active measures such as repair or removal may be recommended. The following matrix provides guidance for recommended Actions in the absence of renovation or demolition. In the event of construction or maintenance activity which will disturb ACM more aggressive control or removal will be required.

5.1 Action Matrix

The following tables outline the action decisions based on the relationship of assessed factors. Table I applies to friable ACM. Table II applies to non-friable ACM.

Table I Decision Matrix for Friable ACM

	Condition			
Access	**Good**	**Fair**	**Poor**	**Debris**
(A)	Action 5[1]	Action 5[2]	Action 3	Action 1
(B)	Action 7	Action 6[3]	Action 3	Action 1
(C) Visible	Action 7	Action 6	Action 3	Action 2
(C) Not Visible	Action 7	Action 7	Action 4	Action 2
(D)	Action 7	Action 7	Action 7	Action 7
Air Plenum in Access A, B, C, D	Action 5	Action 5	Action 3	Action 1

Table II Decision Matrix for Potentially Friable and Non-Friable ACM

	Condition			
Access	**Good**	**Fair**	**Poor**	**Debris**
(A)	Action 7	Action 7[4]	Action 3	Action 1
(B)	Action 7	Action 7	Action 3	Action 1
(C) Visible	Action 7	Action 7	Action 4	Action 2
(C) Not Visible	Action 7	Action 7	Action 4	Action 2
(D)	Action 7	Action 7	Action 7	Action 7

[1] If friable ACM in access (A)/Good condition is not proactively removed Action 7 (Manage) is recommended.

[2] If friable ACM in access (A)/Fair condition is not proactively removed repair is recommended.

[3] If friable ACM in access (B)/Fair condition is likely to be disturbed after repair proactive removal is recommended.

[4] Action 7 is recommended for all non-friable ACM in Fair condition however some clients may wish to repair or take some action primarily for cosmetic reasons

Access	Condition			Debris
	Good	Fair	Poor	
Air Plenum in Access A, B, C	Action 7	Action 7	Action 3	Action 1
Air Plenum in Access D	Action 7	Action 7	Action 7	Action 7

5.2 Action Definitions

The following are the definitions in the Action Matrix Table presented above:

Action Definitions	
Action 1	Clean-Up of ACM Debris Restrict access that is likely to cause a disturbance of the ACM Debris and clean up ACM Debris. Utilize appropriate asbestos precautions.
Action 2	Precautions for Access Which may Disturb ACM Debris Use appropriate means to isolate the debris or to limit entry to the area which may disturb the material. At locations where ACM Debris can remain in place in lieu of removal or clean-up (e.g. Debris on top of ceiling tiles or behind lockable door), Utilize appropriate asbestos precautions to enter the area if this will disturb debris. The precautions will be required until the ACM Debris has been cleaned up.
Action 3	ACM Removal Remove ACM. Utilize asbestos procedures appropriate to the scope of the removal work. Until it is removed, restrict access to the material so it is not disturbed.
Action 4	Precautions for Work Which may Disturb ACM in Poor Condition. Utilize appropriate asbestos precautions if ACM may be disturbed by work on or near ACM. This does not require restricting access to the area, only control of work which may contact or disturb the ACM. Removal is the only viable option if work will disturb ACM.
Action 5	Proactive ACM Removal Remove friable ACM where the presence of friable asbestos in Good condition is not desirable. If friable ACM in Fair condition is not removed then Repair friable ACM.
Action 6	ACM Repair Repair friable ACM in Fair condition which is not likely to be damaged again or disturbed by normal use of the area or room. Pinchin recommends proactive removal if friable ACM is likely to be damaged or disturbed during normal use of the area or room
Action 7	Asbestos Management Program with Routine Surveillance Implement an Asbestos Management Program, including routine surveillance of ACM. Reassess materials regularly (typically once per year).

Master Template: Methodology Annex A to Appendix I Evaluation Criteria, HAZ, July 21, 2017

APPENDIX IV

Location List

HMIS
HAZARDOUS MATERIALS INVENTORY SYSTEM

LOCATIONS LIST

PINCHIN
1.855.PINCHIN www.pinchin.com

Client: **Site: Employee Housing, Tofino, BC** **Building Name: E0841** **Surveyor: Raymond Leung** **Survey Date: 2018-02-14**

Location No.	Name or Description	ft^2	Floor No.	Notes
1	Front Entrance And Stairs	100	MAIN	
2	Hallway	100	MAIN	
3	Washroom	100	MAIN	
4	Southeast Room And Ensuite	250	MAIN	
5	Northeast Room	150	MAIN	
6	North Room	150	MAIN	
7	Living And Dining Room	300	MAIN	
8	Kitchen	150	MAIN	
9	Stairs And Hallway	100	BST	
10	Laundry And Side Entrance	150	BST	
11	Furnace Room	100	BST	
12	Recreational Area And Gym	400	BST	
13	South Room	150	BST	

APPENDIX V

Summary Report

HMIS
HAZARDOUS MATERIALS INVENTORY SYSTEM

HAZARDOUS MATERIALS SUMMARY / SAMPLE LOG

PINCHIN
1.855.PINCHIN www.pinchin.com

Client: **Site: Employee Housing, Tofino, BC** **Building Name: E0841** **Surveyor: Raymond Leung** **Survey Date:**

HAZMAT	Sample No	System/Material/Sample Description	Locations	LF	SF	EA	%(SF)	Type	Positive
Asbestos	S0001 ABDEC	WALL | DRYWALL AND JOINT COMPOUND |	1,2,3,4,5,6,7,8	0	3450	0	0	Chrysotile	Yes
Asbestos	S0002 ABDEC	CEILING | TEXTURE COAT |	1,2,4,5,6,7	0	1050	0	0	Chrysotile	Yes
Asbestos	S0003	FLOOR | VINYL SHEET FLOORING (WITH BACKI | BEIGE SQUARES	1,3,4,8	0	350	0	0	None Detected	No
Asbestos	S0004 ABC	CEILING | LAY-IN CEILING TILES |	9,10,12,13	0	800	0	0	None Detected	No
Asbestos	S0005 ABC	WALL | DRYWALL AND JOINT COMPOUND |	9,10,12,13	0	1100	0	0	None Detected	No

HMIS
HAZARDOUS MATERIALS INVENTORY SYSTEM

Asbestos Summary Report

PINCHIN
1.855.PINCHIN www.pinchin.com

Client:
Site: Employee Housing, Tofino, BC **Building Name: E0841**
Surveyor: Raymond Leung **Survey Date:** **Reassessment Surveyor:** **Last Re-Assessment:**

System	Asbestos	Friable	ACM Materials	Locations where ACM materials are present - Location(Room Number)	Recommended Actions	Quantity
C - Ceiling	Yes	Yes	Texture Coat	1, 2, 4, 5, 6, 7	7	1050
		No	Drywall and joint compound	1, 2, 3, 4, 5, 6, 7, 8	7	1300 SF
D - Duct	No	No				
		Yes				
F - Floor	No	No				
		Yes				
M - Mechanical Equipment	No	No				
		Yes				
P - Piping	No	No				
		Yes				
S - Structure	No	No				
		Yes				
W - Wall	Yes	No				
		No	Drywall and joint compound	1, 2, 3, 4, 5, 6, 7, 8	7	2150 SF

APPENDIX VI

All Data Report

HMIS
HAZARDOUS MATERIALS INVENTORY SYSTEM

ALL DATA REPORT

PINCHIN
1.855.PINCHIN www.pinchin.com

Client:
Site: Employee Housing, Tofino, BC **Building Name: E0841** **Location #: 1** **Location Name: Front Entrance And Stairs** **Floor: MAIN**
Surveyor: Raymond Leung **Survey Date: 2018-02-14** **Reassessment Surveyor:** **Last Re-Assessment:**

ASBESTOS															
System	Component	Material	Item	Covering	A*	V*	AP*	Good	Fair	Poor	Unit	Sample	Asbestos Type	Amount	Hazard
Ceiling	All	Texture Coat			C	Y	N	100			SF	S0002A	CHRYSOTILE	0.5-5%	Confirmed Asbestos(F)
Ceiling	All	Drywall and joint compound		Texture Coat	D	N	N	100			SF	V0001	CHRYSOTILE	0.5-5%	Confirmed Asbestos(NF)
Duct	All	None Found													
Floor	All	Vinyl sheet flooring (with backi, Beige squares			A	Y	N	100			SF	S0003	NONE DETECTED		None
Mechanical Equipment	All	None Found													
Piping	All	None Found													
Structure	All	Wood													
Wall	All	Drywall and joint compound			A	Y	N	150			SF	S0001A	CHRYSOTILE	0.5-5%	Confirmed Asbestos(NF)

Client:
Site: Employee Housing, Tofino, BC **Building Name: E0841** **Location #: 2** **Location Name: Hallway** **Floor: MAIN**
Surveyor: Raymond Leung **Survey Date: 2018-02-14** **Reassessment Surveyor:** **Last Re-Assessment:**

ASBESTOS															
System	Component	Material	Item	Covering	A*	V*	AP*	Good	Fair	Poor	Unit	Sample	Asbestos Type	Amount	Hazard
Ceiling	All	Texture Coat			C	Y	N	100			SF	V0002	CHRYSOTILE	0.5-5%	Confirmed Asbestos(F)
Ceiling	All	Drywall and joint compound		Texture Coat	D	N	N	100			SF	V0001	CHRYSOTILE	0.5-5%	Confirmed Asbestos(NF)
Duct	All	None Found													
Floor	All	Wood, Wood laminate									SF				
Floor	All	Wood, Wood laminate													
Mechanical Equipment	All	None Found													
Piping	All	None Found													
Structure	All	Wood													
Wall	All	Drywall and joint compound			A	Y	N	150			SF	V0001	CHRYSOTILE	0.5-5%	Confirmed Asbestos(NF)

Client:
Site: Employee Housing, Tofino, BC **Building Name: E0841** **Location #: 3** **Location Name: Washroom** **Floor: MAIN**
Surveyor: Raymond Leung **Survey Date: 2018-02-14** **Reassessment Surveyor:** **Last Re-Assessment:**

ASBESTOS															
System	Component	Material	Item	Covering	A*	V*	AP*	Good	Fair	Poor	Unit	Sample	Asbestos Type	Amount	Hazard
Ceiling	All	Drywall and joint compound			C	Y	N	100			SF	V0001	CHRYSOTILE	0.5-5%	Confirmed Asbestos(NF)
Duct	All	None Found													
Floor	All	Vinyl sheet flooring (with backi, Beige squares			A	Y	N	100			SF	V0003	NONE DETECTED		None
Mechanical Equipment	All	None Found													
Piping	All	Not Insulated													
Structure	All	Wood													
Wall	All	Drywall and joint compound			A	Y	N	150			SF	V0001	CHRYSOTILE	0.5-5%	Confirmed Asbestos(NF)

Client:
Site: Employee Housing, Tofino, BC **Building Name: E0841** **Location #: 4** **Location Name: Southeast Room And Ensuite** **Floor: MAIN**
Surveyor: Raymond Leung **Survey Date: 2018-02-14** **Reassessment Surveyor:** **Last Re-Assessment:**

ASBESTOS															
System	Component	Material	Item	Covering	A*	V*	AP*	Good	Fair	Poor	Unit	Sample	Asbestos Type	Amount	Hazard
Ceiling	All	Texture Coat			C	Y	N	250			SF	S0002B	CHRYSOTILE	0.5-5%	Confirmed Asbestos(F)
Ceiling	All	Drywall and joint compound		Texture Coat	D	N	N	250			SF	V0001	CHRYSOTILE	0.5-5%	Confirmed Asbestos(NF)
Duct	All	None Found													
Floor	All	Vinyl sheet flooring (with backi, Beige squares			A	Y	N	50			SF	V0003	NONE DETECTED		None
Floor		Wood, Wood laminate													
Mechanical Equipment	All	None Found													
Piping	All	None Found													
Structure	All	Wood													
Wall	All	Drywall and joint compound			A	Y	N	400			SF	S0001B	CHRYSOTILE	0.5-5%	Confirmed Asbestos(NF)

Client:
Site: Employee Housing, Tofino, BC **Building Name: E0841** **Location #: 5** **Location Name: Northeast Room** **Floor: MAIN**
Surveyor: Raymond Leung **Survey Date: 2018-02-14** **Reassessment Surveyor:** **Last Re-Assessment:**

ASBESTOS															
System	Component	Material	Item	Covering	A*	V*	AP*	Good	Fair	Poor	Unit	Sample	Asbestos Type	Amount	Hazard
Ceiling	All	Texture Coat			C	Y	N	150			SF	S0002D	CHRYSOTILE	0.5-5%	Confirmed Asbestos(F)
Ceiling	All	Drywall and joint compound		Texture Coat	D	N	N	150			SF	V0001	CHRYSOTILE	0.5-5%	Confirmed Asbestos(NF)
Duct	All	None Found													
Floor		Wood, Wood laminate													
Mechanical Equipment	All	None Found													
Piping	All	None Found													
Structure	All	Wood													
Wall	All	Drywall and joint compound			A	Y	N	250			SF	S0001D	CHRYSOTILE	0.5-5%	Confirmed Asbestos(NF)

Client:
Site: Employee Housing, Tofino, BC **Building Name: E0841** **Location #: 6** **Location Name: North Room** **Floor: MAIN**
Surveyor: Raymond Leung **Survey Date: 2018-02-14** **Reassessment Surveyor:** **Last Re-Assessment:**

ASBESTOS															
System	Component	Material	Item	Covering	A*	V*	AP*	Good	Fair	Poor	Unit	Sample	Asbestos Type	Amount	Hazard
Ceiling	All	Texture Coat			C	Y	N	150			SF	S0002E	CHRYSOTILE	0.5-5%	Confirmed Asbestos(F)
Ceiling	All	Drywall and joint compound		Texture Coat	D	N	N	150			SF	V0001	CHRYSOTILE	0.5-5%	Confirmed Asbestos(NF)
Duct	All	None Found													
Floor		Wood, Wood laminate													
Mechanical Equipment	All	None Found													
Piping	All	None Found													
Structure	All	Wood													
Wall	All	Drywall and joint compound			A	Y	N	250			SF	S0001E	CHRYSOTILE	0.5-5%	Confirmed Asbestos(NF)

Client:
Site: Employee Housing, Tofino, BC **Building Name: E0841** **Location #: 7** **Location Name: Living And Dining Room** **Floor: MAIN**
Surveyor: Raymond Leung **Survey Date: 2018-02-14** **Reassessment Surveyor:** **Last Re-Assessment:**

ASBESTOS															
System	Component	Material	Item	Covering	A*	V*	AP*	Good	Fair	Poor	Unit	Sample	Asbestos Type	Amount	Hazard
Ceiling	All	Texture Coat			C	Y	N	300			SF	S0002C	CHRYSOTILE	0.5-5%	Confirmed Asbestos(F)
Ceiling	All	Drywall and joint compound		Texture Coat	D	N	N	300			SF	V0001	CHRYSOTILE	0.5-5%	Confirmed Asbestos(NF)
Duct	All	None Found													
Floor	All	Wood, Wood laminate													
Floor	All	Wood, Wood laminate													
Mechanical Equipment	All	None Found													
Piping	All	None Found													
Structure	All	Wood													
Wall	All	Drywall and joint compound			A	Y	N	500			SF	S0001C	CHRYSOTILE	0.5-5%	Confirmed Asbestos(NF)

Client:
Site: Employee Housing, Tofino, BC **Building Name: E0841** **Location #: 8** **Location Name: Kitchen** **Floor: MAIN**
Surveyor: Raymond Leung **Survey Date: 2018-02-14** **Reassessment Surveyor:** **Last Re-Assessment:**

ASBESTOS															
System	Component	Material	Item	Covering	A*	V*	AP*	Good	Fair	Poor	Unit	Sample	Asbestos Type	Amount	Hazard
Ceiling	All	Drywall and joint compound			C	Y	N	150			SF	V0001	CHRYSOTILE	0.5-5%	Confirmed Asbestos(NF)
Duct	All	None Found													
Floor	All	Vinyl sheet flooring (with backi, Beige squares			A	Y	N	100			SF	V0003	NONE DETECTED		None
Mechanical Equipment	All	None Found													
Piping	All	Not Insulated													
Structure	All	Wood													
Wall	All	Drywall and joint compound			A	Y	N	300			SF	V0001	CHRYSOTILE	0.5-5%	Confirmed Asbestos(NF)

Client:
Site: Employee Housing, Tofino, BC **Building Name: E0841** **Location #: 9** **Location Name: Stairs And Hallway** **Floor: BST**
Surveyor: Raymond Leung **Survey Date: 2018-02-14** **Reassessment Surveyor:** **Last Re-Assessment:**

ASBESTOS														
System	Component	Material	Item	Covering	A*	V*	AP*	Good	Fair	Poor	Unit	Sample	Asbestos Type	Amount	Hazard
Ceiling	All	Lay-in ceiling tiles			C	Y	N	100			SF	S0004A	NONE DETECTED		None
Duct	All	None Found													
Floor	All	Wood, Wood laminate													
Mechanical Equipment	All	None Found													
Piping	All	None Found													
Structure	All	Wood													
Wall	All	Drywall and joint compound			A	Y	N	100			SF	S0005A	NONE DETECTED		None

Client:
Site: Employee Housing, Tofino, BC **Building Name: E0841** **Location #: 10** **Location Name: Laundry And Side Entrance** **Floor: BST**
Surveyor: Raymond Leung **Survey Date: 2018-02-14** **Reassessment Surveyor:** **Last Re-Assessment:**

ASBESTOS														
System	Component	Material	Item	Covering	A*	V*	AP*	Good	Fair	Poor	Unit	Sample	Asbestos Type	Amount	Hazard
Ceiling	All	Lay-in ceiling tiles			C	Y	N	150			SF	S0004B	NONE DETECTED		None
Duct	All	None Found													
Floor	All	Wood, Wood laminate													
Mechanical Equipment	All	None Found													
Piping	All	None Found													
Structure	All	Wood													
Wall	All	Drywall and joint compound			A	Y	N	200			SF	S0005B	NONE DETECTED		None

Client:
Site: Employee Housing, Tofino, BC **Building Name: E0841** **Location #: 11** **Location Name: Furnace Room** **Floor: BST**
Surveyor: Raymond Leung **Survey Date: 2018-02-14** **Reassessment Surveyor:** **Last Re-Assessment:**

ASBESTOS															
System	Component	Material	Item	Covering	A*	V*	AP*	Good	Fair	Poor	Unit	Sample	Asbestos Type	Amount	Hazard
Ceiling	All	None Found													
Duct	All	None Found													
Floor	All	Concrete(poured)													
Mechanical Equipment	All	Not Insulated													
Piping	All	Not Insulated													
Structure	All	Wood													
Wall	All	Drywall													

Client:
Site: Employee Housing, Tofino, BC **Building Name: E0841** **Location #: 12** **Location Name: Recreational Area And Gym** **Floor: BST**
Surveyor: Raymond Leung **Survey Date: 2018-02-14** **Reassessment Surveyor:** **Last Re-Assessment:**

ASBESTOS															
System	Component	Material	Item	Covering	A*	V*	AP*	Good	Fair	Poor	Unit	Sample	Asbestos Type	Amount	Hazard
Ceiling	All	Lay-in ceiling tiles			C	Y	N	400			SF	S0004C	NONE DETECTED		None
Duct	All	None Found													
Floor	All	Wood, Wood laminate													
Mechanical Equipment	All	None Found													
Piping	All	None Found													
Structure	All	Wood													
Wall	All	Drywall and joint compound			A	Y	N	600			SF	S0005C	NONE DETECTED		None

Client:
Site: Employee Housing, Tofino, BC **Building Name: E0841** **Location #: 13** **Location Name: South Room** **Floor: BST**
Surveyor: Raymond Leung **Survey Date: 2018-02-14** **Reassessment Surveyor:** **Last Re-Assessment:**

ASBESTOS															
System	Component	Material	Item	Covering	A*	V*	AP*	Good	Fair	Poor	Unit	Sample	Asbestos Type	Amount	Hazard
Ceiling	All	Lay-in ceiling tiles			C	Y	N	150			SF	V0004	NONE DETECTED		None
Duct	All	None Found													
Floor	All	Wood, Wood laminate													
Mechanical Equipment	All	None Found													
Piping	All	None Found													
Structure	All	Wood													
Wall	All	Drywall and joint compound			A	Y	N	200			SF	V0005	NONE DETECTED		None

Legend:

Sample number	
S####	Sample collected.
V####	Material is visually identified to be identical to S####
V0000	Known non asbestos material.
V9000	Material is visually identified to contain asbestos.
V9500	Material is presumed to contain asbestos.

Units	
SF	Square feet
LF	Linear feet
EA	Each
%	Percentage

Other	
SVM	Suspect Visible Mould
A	Access
V	Visible
AP	Air Plenum
F	Friable material.

Access	
A	Accessible to all building occupants
B	Accessible to maintenance and operations staff without a ladder
C	Accessible to maintenance and operations staff with a ladder. Also rarely entered, locked areas.
D	Not normally accessible or without demolition

Condition	
Good	No visible damage or deterioration
Fair	Minor, repairable damage, cracking or deterioration.
Poor	Irreparable damage or deterioration with exposed and missing material.