



CU Construction & Design Guidelines

2026

Division 01 – General Requirements

All new construction and renovation projects on Carleton University campuses are required to meet the Carleton University Facilities Design Guidelines. Including from the initial planning and design stages through to the various phases of construction and facilities maintenance and management. They are to mirror planning, design, construction, maintenance, and other facilities supporting University personnel. These documents are to be used as a guideline only on all Carleton University projects and are not to be used for bidding, permitting construction, or any other purpose. Any changes or substitutions must be approved by Carleton University Facilities Management and Planning (CUFMP) and must be submitted in writing. This document is the property of Carleton University. Any use of this document, in part or in whole, for purposes other than a Carleton University project cannot be done without written permission from the University.

Table of Contents

01 11 00 Summary of Work	3
01 12 00 Multiple Contract Summary.....	3
01 14 00 Work Restrictions.....	3
01 14 25 Designated Substances Report	3
01 21 00 Allowances	3
01 23 00 Alternatives	3
01 29 00 Payment Procedures.....	3
01 31 19 Project Meetings.....	3
01 33 00 Submittal Procedures.....	6
01 33 29 Sustainable Design Reporting	6
01 35 13.43 Special Project Procedures for Contaminated Sites	7
01 35 13.93 Special Project Procedures during COVID-19 Pandemic.....	8
01 35 43 Environmental Procedures.....	8
01 41 00 Regulatory Requirements	13
01 43 00 Quality Assurance	13
01 45 00 Quality Control	13
01 47 13 Sustainable Requirements: Concept Design	15
01 47 15 Sustainable Requirements: Construction.....	17
01 51 00 Temporary Utilities	17
01 52 00 Construction Facilities.....	17
01 55 26 Traffic Control	19
01 56 00 Temporary Barriers and Enclosures	19
01 74 00 Cleaning.....	19
01 74 19 Waste Management and Disposal	19
01 77 00 Closeout Procedures and Submittals.....	20
01 79 00 Demonstration and Training	20
01 91 13 General Commissioning Requirements.....	21
01 91 13.13 Commissioning Plan	21
01 91 13.16 Commissioning Forms	26

01 11 00 Summary of Work

To be revised as required for each project.

01 12 00 Multiple Contract Summary

To be revised as required for each project.

01 14 00 Work Restrictions

To be revised as required for each project.

01 14 25 Designated Substances Report

- .1 Carleton University shall provide any prospective constructor or contractor a copy of building ACM surveys and information on designated substances that are known or suspected of being present within the area or scope of work.
- .2 The constructor or General Contractor shall ensure that a copy of the ACM survey is provided to each contractor and subcontractor who will be working in the space.
- .3 Any findings of undeclared ACM, or damaged ACM that could pose a risk to workers is to be brought to the attention of the Carleton authorized contact immediately, and work is to be stopped.
- .4 All project design and construction activities must be carried out in compliance with the Regulations and the [Carleton University Asbestos Management Program](#) and the [Asbestos Management Plan](#)
- .5 Laboratory or similar spaces where hazardous materials might pose a hazard to prospective constructors or contractors will have been reviewed in accordance with Carleton University's [Decommissioning Guidelines](#).
- .6 No asbestos-containing materials, as defined by O. Reg. 278/05, may be specified or used in any project.

01 21 00 Allowances

If applicable, all cash allowances to be clearly identified on the bid form, and in the relevant specifications and drawings

01 23 00 Alternatives

Alternate Prices are not included in the Base Bid. The intent of Alternate Prices is to allow the Owner to substitute alternate items listed for the prices quoted at the Owner's discretion.

01 29 00 Payment Procedures

01 31 19 Project Meetings

Post Bid Meeting

- .1 A Post Bid Meeting may be convened and chaired by FMP PM with the Consultant, proposed Contractor, and major Subcontractors to review the contract documents, bids, and implementation plan. If required, this meeting will be prior to FMP issuing a Letter of Intent or

Contract and subject to requisite FMP approvals. This meeting does not constitute or infer any contract award to the proposed contractor or any other contractor.

- .2 Agenda may include, but is not limited to:
 - .1 Review Bid/Tender
 - contract amount/taxes
 - separate prices/alternate prices
 - itemized prices
 - allowances
 - list of subcontractors and suppliers
 - post tender addenda/negotiations
 - insurance
 - .2 Approvals
 - building permit status
 - site plan approval
 - FMP approvals
 - .3 Schedule
 - mobilization
 - service locates
 - non-University
 - long-delivery items
 - phasing
 - completion
 - .4 Site Set-Up
 - access and staging areas
 - hoarding and signage
 - security and lighting
 - use of temporary services
 - power
 - water
 - washrooms
 - cleaning equipment
 - waste holding and removal
 - parking
 - site contacts
 - contractor
 - consultants
 - Carleton University
 - building/ground/road closures
 - .5 Contract Administration
 - testing and inspecting
 - FMP
 - consultants
 - contractor
 - service interruptions
 - shop drawings
 - site meetings - set date for first meeting

Division 01 – General Requirements

- change notices/site instructions
 - progress draws
 - release of holdback
 - correspondence
 - contract close-out
 - as-built drawings and manuals
 - substantial completion ad
 - WSIB and statutory declaration
 - commissioning
 - warranties
 - spare materials and parts
- .6 University Policies and Procedures
- Vaccination and screening requirement
 - safety
 - site
 - confined space entry
 - asbestos
 - training
 - waste audit
 - harassment
 - WHMIS
 - training
 - keys
- .7 Award
- letter of intent
 - purchase order or contract
 - contract documents
 - proof of insurance (Must name Carleton University and Consultant)
 - notice of project (Ministry of Labour)
 - contractor safety policy
 - cash flow schedule

Administrative

- .1 The FMP PM along with the consultant will administer and record all design, kick-off and Pre-Contract Award Meeting(s) and the Contractor will administer and record all Construction Meetings.
- .2 Construction Meetings are at the call of the FMP PM or Consultant, until Project Completion. Agenda to include the following:
- i. Review, approval of minutes of previous meeting
 - ii. Review of Work progress since previous meeting
 - iii. Field observations, problems, conflicts
 - iv. Problems which impede construction schedule
 - v. Review of off-site fabrication delivery schedules
 - vi. Corrective measures and procedures to regain projected schedule
 - vii. Revisions to construction schedule
 - viii. Progress schedule during succeeding work period and effect on occupants
 - ix. Review submittal schedules: expedite as required

- x. Maintenance of quality standards
 - xi. Pending changes and substitutions
 - xii. Review proposed changes for effect on construction schedule and on completion date
 - xiii. Other business
- .3 The contractor is responsible for the administration and recording duties, which includes but is not limited to:
- i. Distribute agenda of each meeting a minimum of (5) business days in advance of meeting dates to FMP PM, Consultant, Contractor, Subcontractors and Suppliers.
 - ii. Provide physical space (coordinate with the Carleton University FMP PM).
 - iii. Record meeting minutes. Include significant proceedings and decisions and identify “Action By” parties.
 - iv. Reproduce and distribute copies of minutes electronically within (3) business days following each meeting and transmit to meeting participants and affected parties not in attendance.
- .4 Representative(s) of Contractor, Subcontractor and Suppliers attending meetings shall be qualified and authorized to act on behalf of each party represented.

01 33 00 Submittal Procedures

01 33 29 Sustainable Design Reporting

General

Overview

- .1 Carleton University is committed to advancing the campus towards carbon neutrality by 2050 while maintaining indoor environments that are comfortable and enhance health and wellbeing.
- .2 Buildings are the greatest consumers of energy and source of greenhouse gas emissions (GHG) on campus. This section focuses on reducing energy usage and related GHG emissions on campus.

This section has been prepared to provide direction and resources for three types of projects; Major capital projects, minor capital projects and all other projects such as infrastructure, soft or hard landscaping, stormwater management, or exterior lighting. Further definition of each project classification is shown below;

Major Capital – All new building construction projects and major renovations that include mechanical and electrical system upgrades or replacement, building envelope improvements and major room/lab re-design/re-purposing.

Minor Capital – these projects typically include minor space renovation, or replacement of single piece of capital system such as mechanical, electrical equipment or furniture.

Site Project – project examples include but are not limited to exterior projects such as major waterworks or other infrastructure, soft and hard landscaping, tunnels, exterior lighting or other areas.

It is recognized that flexibility will be required in the interpretation of the above definitions and how the guidelines will be applied. Any variances will be approved by Facilities Management Planning on a case-by-case basis.

01 35 13.43 Special Project Procedures for Contaminated Sites

- .1 Contaminants include, but not limited to:
 1. Any groundwater, surface water, soil, building material or other material on the Site which contains any hazardous substance which exceeds the **MECP** background standards or the standards permitted for use at the Site under applicable Environmental Laws and Regulations, including the Records of Site Condition regulation 153/04 under the Environmental Protection Act (Ontario).
- .2 If the GC is in law responsible excavates, disturbs, moves, manipulates, treats, pumps, transports or otherwise handles or deals with, or is required to do any of the foregoing for the purposes of the work for any Contaminant on the Site (whether such contamination is existing, foreseeable, non-foreseeable or subsequent), the GC shall:
 - .1 Obtain from an independent and qualified Environmental Consultant, accepted by the CUFMP, the required Environmental Site assessment studies for the Site.
 - .2 Initiate and complete any assessment, remedial, by removal and disposal, such Contaminant as the case may be (unless an alternative method of contamination management is accepted).
 - .3 Ensure that neither the GC nor any person for whom the GC is in law responsible contributes to or exacerbates, or causes the leaching or migration of, any contamination on the Site or onto any adjacent properties, including the sewer systems, land, water or air.
- .3 Notifications:
 - .1 The GC shall promptly notify the Office of Risk Management of:
 - .1 Any release of a hazardous substance or any other occurrence or condition involving hazardous substances at or affecting the Carleton University property.
 - .2 Any release that may subject the GC, sub-contractors or Carleton University of any fines, penalties, orders, investigations or other proceedings under any Environmental Laws.
 - .3 The identification of any contamination uncovered in the course of a project which was not disclosed previously.
 - .4 All charges, orders, investigations or notices of violation or non-compliance issued against the GC or relating to the performance of work completed at a Carleton University property under any Environmental law.
 - .5 Any notice, claim, action or other proceeding by any person against the GC or relating to the performance of work completed at a Carleton University property concerning the release or alleged release of any Contaminant.
 - .2 The GC shall immediately notify the relevant Environmental authorities of any release of any hazardous substance at or from Carleton University property as required pursuant to and in accordance with Environmental laws. In the event of a failure from the GC to provide such a notice, Carleton University may notify the relevant Environmental authorities of such occurrence.

01 35 13.93 Special Project Procedures during COVID-19 Pandemic

Effective June 25th, 2022:

The University has paused its mandatory mask mandate. Even though masks will no longer be mandatory, we continue to strongly recommend masking when indoors, particularly if physical distancing cannot be maintained. Please note that as health care facilities, Health and Counselling Services and the Sports Medicine Clinic will continue to require masks.

Any questions or concerns, please contact covidinfo@carleton.ca.

To stay up to date on COVID-19 health and safety measures at the University, please visit <https://carleton.ca/covid19/>. For specific information related to health and safety measures for contractors and suppliers visiting Carleton's campus, please also visit <https://carleton.ca/procurement/covid-19-screening-requirement-for-suppliers/>.

01 35 43 Environmental Procedures

General

Overview

- .1 This section has been prepared to provide Consultants with a general overview of Environmental requirements for new buildings and renovations in existing buildings.
- .2 Environmental considerations are part of all activities and operations within the Carleton University. All Contractors & Consultants must understand their Environmental responsibilities conforming to all related laws and regulations, including, but not limited to, Carleton University related policies, directives, procedures and Guidelines, especially [Environment and Sustainability Policy](#) which contains the following key commitments:
 - .1 Continual Environmental Performance Improvement.
 - .2 Pollution Prevention.
 - .3 Regulatory Compliance.
- .3 All obligation, procedures and policies described in this section shall be depending on the project size and design context. Consultants shall review project requirements with CUFMP - including Office of Risk Management to determine other related required services when the project or any part of the work involves the following, but not limited to:
 - .1 Excavations greater than 5m² and 15cm deep.
 - .2 Demolition.
 - .3 Laboratory and workshop renovations, upgrades, relocation or decommissioning.
 - .4 Hazardous waste management.
 - .5 Installation, modification, replacement and decommissioning (or any other work outside regular maintenance), in parts or in whole, for:
 - HVAC systems, Boilers & Chillers.

- Fume hoods, canopy hoods and paint booths.
- Exhaust fans, rooftop and wall mounted.
- Stacks.
- Emergency generators and associated fuel systems.
- Storm, sanitary and combined sewer systems.

Environmental Management

Construction Environmental Management Plan (CEMP):

- .1 CEMP specific requirements are defined as follow:
 - .1 Complies with all applicable requirements in the Environmental scope.
 - .2 Identifies the roles and provides detailed descriptions of the responsibilities and communication protocols of the members of the GC's Environmental team and Carleton University.
 - .3 Identifies and provides detailed descriptions of monitoring and reporting requirements.
 - .4 Sets out the initial list of the sensitive Environmental issues and compliance requirements, in connection with which the GC shall prepare Environmental Work Plans described below.
 - .5 Includes the Component Plans listed below.
 - .6 Complies with all of the GC's and Carleton University's Environmental obligations and policies, listed in this document.
- .2 CEMP Component Plans: As applicable and to address the various phases of the work, shall consist, of the following components (as minimum):
 - .1 Communications Plan: Describing the approach for communicating and collaborating on the project, including all internal and external members of the project team and relevant management stakeholders, the information to be communicated and the methods used shall be regularly updated on different phases.
 - .2 Construction Schedule: Including the schedule for obtaining Environmental studies, permits, authorizations and/or approvals, Environmental tasks towards mitigation and/or compliance measures and, if required, work restrictions planned during the overall project schedule.
 - .3 Contaminated Sites Management Plan (CSMP): the owner will undertake any environmental site assessments (ESA) as required.

Based on the ESA the GC shall be responsible for the plan to remediate the site to address the conditions outlined in the ESA. The GC will address any other issue related to contamination encountered during the course of the project. This must also include requirements for long-term monitoring, if applicable.

- .4 Air Quality and Dust Control Management Plan (AQDCMP): Describing the measures to be used to control dust during construction and the program that will be implemented to monitor nuisance dust concentrations, ambient particulate matter (PM10 and PM2.5), and ambient air quality.
- .5 Surface Erosion Prevention and Sediment Control Plan (SEPCP): Identifying areas and activities that are prone to generate elevated amount of sediments, describe general and Site-specific measures that will be applied to mitigate soil erosion and shallow slope movement, to control sediment-laden flows, and to prevent sediment from entering sanitary and storm sewer systems and adjacent water courses. Shall include a description of the monitoring program that will be implemented on the proposed Site specific measures.
- .6 Construction Site Dewatering Plan (CSDP): Identifying measures necessary to plan and manage dewatering operations in compliance with federal, provincial and municipal regulations both prior to and during construction activities. It must describe the general steps and roles and responsibilities with respect to assessment requirements, permits, authorizations and approvals, construction dewatering and disposal procedures, management of construction Site run-off, melt water run-off and sediment control. It shall also include the measures that will be implemented to manage and remove snow from the site in a timely and efficient manner with considerations for contaminated sediments.
- .7 Noise and Vibration Management Plan (NVMP): Describing Site-specific schedule pertaining to noise and vibration-generating activities, procedures and Best Management Practices to control Construction noise emissions including target noise emission levels of equipment, equipment maintenance, management and education, Carleton University community communication, and noise monitoring. The goal is to minimize impacts and allowing Carleton University Community and GC enough time for implementing appropriate identified measures towards achieving acceptance of unavoidable noise and/or vibration.
- .8 Fuels, Chemicals and Materials Storage and Handling Management Plan (FCMSHMP): Describing procedures and Best Management Practices for the transport, inventory and storage of Hazardous Substances, servicing of equipment and equipment operations in Environmentally sensitive areas, including but not limited to, near sewer manholes.
- .9 Spill Prevention and Emergency Response Plan (SPERP): Identifying potential spills, list the spill abatement materials and equipment to

be stored on the Site, responsible work personnel and external contacts, training procedures, recovery procedures including communications, containment, clean-up, debriefing and follow-up reporting.

- .10 Solid and Liquid Waste Management Plan (SLWMP): Describing measures that will be implemented to reduce, reuse and recycle solid waste, as well as the disposal plan for solid, non-hazardous waste.
- .11 Water Taking Plan and Discharge Plan - produced by a Qualified Person (QP): As per Ontario regulation 153/04 which estimates the dewatering efforts required, analyze potential impacts and, if required, identify where the water can be discharged. The QP will also need to develop a Discharge Plan if there is any discharge of water to occur.

Environmental Work Plans (EWP):

- .1 General:
 - .1 EWP demonstrate the measures which the GC will implement and follow to protect the Environment and to ensure regulatory compliance. Such compliance requirements to include areas that are defined or referenced in permits, authorizations or approvals which relate to or are required under Environmental laws in connection with the work.
 - .2 The information shall be clear and concise as to enable the GC, any Subcontractor of any tier or any other person engaged or involved in the performance of the work, and their respective representatives, agents, employees and Contractors, to effectively use and understand the EWP in connection with the performance of the work.
- .2 EWP specific requirements shall include the following:
 - .1 A description of the Site, or portion thereof applicable to the work described in the EWP, the part of the work that is to be carried out at such part of the Site, the schedule and duration of such part of the work.
 - .2 A description (including maps and drawings, as appropriate) of the Environmental issues or requirements at the Site or portion thereof, and adjacent lands, applicable to the work described in the EWP, including regular maintenance activities.
 - .3 A specification of the applicable sections, terms, conditions and commitments of the CEMP, permits, authorizations and approvals relevant to the specified portion of the Site, the described part of the work, and the described mitigation measures, as applicable.
 - .4 A description of the expected and scheduled timing of internal

Environmental inspections, including full time, daily, and as required inspections, as applicable, and the specific reporting procedures that will apply.

- .5 A description of the emergency procedures and relevant 24/7 GC complete contact information, specific to the applicable portion of the Site.

Environmental Obligations:

GC's obligations

- .1 Depending on the scope, the GC Shall:
 - .1 Perform its duties and obligations in accordance with Best Management Practices related to Environmental compliance and sustainability laws and regulations.
 - .2 Manage, identify, plan and coordinate all Environmental obligations and their potential impacts on the project with the CUFMP.
 - .3 Observe, comply with, and perform all of its duties and obligations, and cause all persons for whom the GC is in law responsible to observe, comply with and perform such duties and obligations.
 - .4 Notify of any circumstance that may require Carleton University to provide notice to Federal, Provincial or Municipal authorities, including regional conservation authorities, in accordance with regulatory requirements.
 - .5 Obtain on behalf of Carleton University all approvals, authorizations and permits, including amendments to existing approvals (except in relation to existing Environmental compliance approvals), authorizations and permits, which relate to or are required under Federal, Provincial and Municipal legislation in connection with the project or any part of the work in their contractual obligations.
 - .6 Maintain copies of all documents, reports, plans, figures, analytical data sets, inspections, emission results, procedures and any other relevant records in connection with the project and the performance of the work relating to Environmental matters.
 - .7 Obtain the authorization of Carleton University's PM prior to provide any type of documents or information to any Environmental authority or other stakeholder in connection with the project and the performance of the work relating to Environmental matters.
 - .8 Submit to the Carleton University's PM for acceptance the preliminary CEMP prior to implementing it and/or submitting to any appropriate Environmental authority or other stakeholder.
- .9 Reports:
 - .1 Promptly forward to the Carleton University's PM - upon request - a copy of any report, submission, application or other document

that is produced or otherwise obtained relating to Environmental matters affecting the work, the Site or any aspect of the project.

- .2 Develop, implement, maintain and update CEMP plans and reports (include updates and supplements to reflect all changes) described above.
- .3 Prepare monthly Environmental management reports that outline the design and construction activities undertaken and projected, key Environmental issues, summaries of weekly inspection activities, mitigation measures (successes and failures), resolutions to Environmental impacts and compliance with all applicable permits, authorizations and approvals. Shall include all Environmental sub-Consultant reports, Environmental incident reports, specific mitigation plans and sediment and drainage plans.

Specialists

Depending on the scope:

- .1 The GC will have available, at all times until the Substantial Completion date, a multi-disciplinary team of qualified Environmental specialists and thereafter shall have available such a team to the extent relevant to the GC's obligations that continue after the Substantial Completion date until the expiry of the Warranty Period.
- .2 The multi-disciplinary team of qualified Environmental specialists shall ensure the day-to-day implementation of the GC's CEMP.
- .3 The job specification and responsibilities of such a team shall include the following:
 - .1 Identification, planning and management of all Environmental issues and compliance requirements associated with all aspects of the Work on a day-to-day basis.
 - .2 Complete internal audits on the performance of the CEMP.
 - .3 Prepare and submit to the Carleton University's PM all reports required under the CEMP and all other documentation and information required.

01 41 00 Regulatory Requirements

01 43 00 Quality Assurance

01 45 00 Quality Control

Independent Inspection Agencies

Division 01 – General Requirements

- .1 Independent Inspection/Testing Agencies may be engaged by FMP for the purpose of inspecting and/or testing portions of Work. The cost of such services will be borne by FMP.
- .2 The contractor is required to co-operate with and support the implementation of inspection and testing by the appointed agencies.
 - Inspections and Testing done by independent agencies do not, in any way, limit the GC's responsibility for ensuring that products and execution of the work meet contract requirements. Upon receipt of reports of inspections and tests, CU, in consultation with the Consultants, will decide upon any action that may be required.

Third party required inspections

General:

- .1 Inspections and Testing may be required by jurisdictional authorities, or by the Contract. Companies engaged for Inspections and Testing may be hired by CU, the GC, its Sub-Contractor, or the Consultant, depending on the scope and budget, and shall be determined at the beginning of every project.
 - Employment of inspection/testing agencies does not relieve the Contractor's responsibility to perform Work in accordance with the Contract Documents.
- .2 If defects are revealed during inspection and/or testing, the appointed agency may request additional inspection and/or testing to ascertain full extent of defect. The contractor is required to correct defects and irregularities as advised by Consultant at no cost to FMP and pay the costs for retesting and re-inspection.
- .3 Notify appropriate agencies and Consultants in advance of the requirement for tests, in order that attendance arrangements can be made. Five (5) working days if possible.
- .4 Submit samples and/or materials required for testing, as specifically requested in Specification. Submit with reasonable promptness and in an orderly sequence so as not to cause delay in the Work.

Access to Work

- .1 Allow inspection/testing agencies, and third-party Access to Work

Mock-ups

- .1 Prepare mock-ups for Work specifically requested in the Specification. Include for Work of all related Sections required to provide mock-ups.
- .2 Prepare mock-ups for Consultant's review with reasonable promptness and in an orderly sequence, so as not to cause any delay in the Work.
- .3 Location of mock up to be confirmed by FMP prior to delivery or installation

- .4 Failure to prepare mock-ups in ample time is not considered sufficient reason for an extension of Contract Time and no claim for extension will be allowed.
- .5 Remove mock-ups when requested by the Consultant or FMP, if not already incorporated into the Work.

01 47 13 Sustainable Requirements: Concept Design

Summary

Overview

1. Carleton University requires projects to be registered and certified under the Canadian Green Building Council Zero Carbon Building Standard where applicable. All other projects shall be registered and certified to the Green Globes Building Certification Program.
2. Carleton is committed to carbon neutrality by 2050 therefore improving buildings energy efficiency is a major objective.

Design

Parameters

Energy Modeling

Architecture

- .1 Building envelope components shall conform or surpass the effective (R-values) requirements in OBC SB-10, prescriptive method with an energy modeling simulation analysis. Use of nominal thermal performance (R-Value) of the wall in the energy models and load calculations are not permitted.
- .2 For new buildings, openings to wall ratio (OWR) shall be minimized. It is strongly recommended to maintain this ration between 25% - 35% maximum. Minimization of OWR shall be combined with daylighting control strategy. Concepts such as utilization of windows with high visible transmittance (VT) and positioned high to simulate a clerestory should be considered. Building orientation as discussed earlier plays a strategic role in effective daylighting.
- .3 Use of building-integrated photovoltaics (BIPV) are solar power generating products or systems that are seamlessly integrated into the building envelope that can serve a dual purpose as an integral component of the building skin and converting solar energy into electricity. BIPV systems should be incorporated into the design where applicable.

Mechanical and Electrical

- .1 Integrated Building Design (IBD) methodology shall apply in all projects.
- .2 The following steps shall be considered in the IBD process:
 - i. Building Load Optimization.
 - ii. High Efficiency Equipment Utilization.
 - iii. Operation Optimization.
 - iv. Commissioning.
- .3 New construction projects that are NOT CAGBC Zero Carbon Building Standard are required to achieve minimum 50% reduction in total energy consumption as compared to the AHSRAE 90.1-

2010 as listed on OBC SB-10. Where feasible total energy reduction of major renovations must also target a 50% reduction in total energy use as compared to ASHRAE 90.1-2010.

- .4 Design of mechanical and electrical systems for all new construction and Extensive Renovations (OBC) shall comply with the requirements outlined in OBC sections 6.5, 7.5, 9.5 or 9.6 of ASHARE 90.1 – 2010 and OBC SB-10 whichever is more stringent.
- .5 It is strongly recommended that the Design Team follow the guidance provided in ASHARE 50% Advanced Energy Design Guides (AEDG50) where applicable to the project type.
- .6 Where requirements outlined in this section are not feasible and/or in contradiction with applicable codes, deviation shall be reviewed by FMP personnel.
- .7 Water conservation measures should be considered in all projects, these could include rain water harvesting systems for building re-use or irrigation purposes.

Life Cycle Cost Analysis (LCCA)

- .1 LCCA shall be applied to all Major Capital projects to consider the total life cycle costs such as; initial cost, utility operating costs with carbon tax and any other required maintenance costs. This way the optimal life cycle cost can be compared as some projects have higher initial costs with lower operational costs.
- .2 LCCA should be applied to all major building components such as building envelope, mechanical and electrical systems and any other applicable system.
- .3 LCCA should include initial costs plus operating costs including utilities, operating and maintenance costs and any equipment replacement costs.
- .4 LCCA shall be prepared in accordance with Standard Practice for Life-Cycle Costs of Buildings and Building Systems, ASTM E917-05 (2010). The timeframe should be included as over 35 years.
- .5 All LCCA assumptions and parameters shall be rendered to FMP personnel for approval before proceeding.

Energy Modeling

- .1 A preliminary energy models shall be prepared in pre-design stage which will identify the largest energy end uses. These models will be used to perform a parametric analysis of the various design options.
- .2 Energy model shall be refined at each stage of the design process and updated accordingly.
- .3 All utility inputs including carbon tax shall be taken into consideration.
- .4 Energy model shall be prepared as outlined in ASHRAE 90.1.

Energy Models Deliverables at Project Phase

The scope of work and deliverables within each project stage are identified below:

Concept Design

- .1 Identify and target the energy/carbon/water goals for the project
- .2 Identify the energy conservation measures and review with FMP personnel
- .3 Identify the thermal performance of the building envelope
- .4 Perform Life Cycle Cost Analysis (LCCA)
- .5 Design Development (at 66% DD and 99% DD)
- .6 Develop energy conservation measures and building envelope concepts.
- .7 Perform preliminary selection of major equipment

- .8 Develop preliminary energy model
- .9 Revise life cycle cost analysis

01 47 15 Sustainable Requirements: Construction

- .1 Carleton has goals to increase its waste diversion rate to 90 % by 2030. To increase waste diversion during construction the following items shall be considered;
 - i. develop a waste management plan to divert at least 80 per cent (by weight) of construction and demolition waste to be recycled, reused and/or salvaged.
 - ii. Source separate waste materials by ensuring multiple bins are used on site. Each bin shall be sufficiently labeled with appropriate signage
 - iii. monthly audit the bins to ensure the materials are being recycled correctly.
 - iv. involve regular communication on daily/weekly meetings to all on-site personnel about source separation non-conformance and their responsibility to comply.

01 51 00 Temporary Utilities

Utilities

- .1 Sanitary Facilities:
 - .1 Existing washroom facilities, if available, may be used by workers with the approval of FMP
 - .2 Any facilities used by workers are to be maintained in a clean condition, and cleaned daily.
- .2 Water Supply:
 - .1 If applicable, source of water will be designated by FMP and the tie-in through a shut-off valve will be made by FMP. All water extensions from this point to the job site will be by the Contractor and these extensions must be fitted with approved backflow device designed for the hazard level. This must be approved and reviewed by FMP to avoid possible accidental reverse flow.
 - .2 Carleton University will meter the consumption on the project.
- .3 Temporary Power and Light Supply:
 - .1 For renovation projects the Contractor may use power available for the building in which the renovation work is being carried out.
 - .2 For major construction projects, where power is not available FMP will provide a 600V supply and the Contractor will be responsible for transformation.
 - .3 Carleton University will meter the consumption on the project.
- .4 Natural Gas:
 - .1 Source of natural gas, if available, will be provided by FMP.
 - .2 Carleton University will meter the consumption on the project.

01 52 00 Construction Facilities

Construction Parking

- 1. Contractors shall make themselves aware of the regulated system of traffic and parking on the University's property. Non-compliance with the regulations may result in a parking ticket or vehicles being towed at the Contractors expense and risk. For information on parking regulations and availability visit the Parking Services website: <https://carleton.ca/parking/>
All costs related to parking shall be carried by the contractor.

Protection

- .1 Protection of Work and Property:
 - .1 The *Contractor* shall protect the *Work*, the *Owner's* property and property adjacent to the *Place of the Work* from damage which may arise as the result of the *Contractor's* operations under the *Contract*, and shall be responsible for such damage, except damage which occurs as the result of:
 - i. errors or omissions in the *Contract Documents*; or
 - ii. acts or omissions by the Owner, the Consultant, Other Contractors, or their agents and employees.
 - .2 Before commencing any work, the *Contractor* shall determine the location of all underground utilities and structures indicated in the *Contract Documents* or that are reasonably apparent in an inspection of the Place of the Work.
 - .3 Should the *Contractor* in the performance of the *Contract* damage the *Work*, the *Owner's* property or property adjacent to the *Place of the Work*, the *Contractor* shall be responsible for making good such damage at the *Contractor's* expense.
 - .4 Should damage occur to the *Work* or the *Owner's* property for which the *Contractor* is not responsible, the *Contractor* shall make good such damage to the *Work* and, if the *Owner* so directs, to the *Owner's* Property.
- .2 Provide protection required to enable existing and adjacent buildings to remain in continuous and normal operation and maintain construction schedule.
- .3 When using existing electrical utilities for construction care must be exercised to ensure power quality of the existing service is not compromised.

Site Offices

- .1 If feasible, offices may be located within existing buildings. Coordinate location with FMP PM and Consultant.

Project Identification

- .1 Construction Signs:
 - .1 Company identification signs are permitted on site, subject to FMP approval.
 - .2 Provide and maintain warning signs as required by governing authorities.
 - .3 Carleton University Project signs are to be present at all project locations. Signs will be provided by FMP PM and installed by the Contractor.

Cleaning

- .1 Maintain the work site in tidy condition, free from the accumulation of waste and debris.
- .2 Remove waste material and debris from the site and deposit in designated waste/recycling container at the end of each working day.
- .3 Clean interior area prior to start of finishing work, maintain areas free of dust and other contaminants during finishing operations.

Equipment/Systems Shut-down

- .1 All shut-downs of building systems and equipment shall be coordinated through the Consultant along with the FMP PM. A minimum of ten (10) business days advance notice is required. Refer to Carleton [Shut Down Request Procedure - Facilities Management and Planning \(carleton.ca\)](http://carleton.ca)

01 55 26 Traffic Control

- .1 Provide traffic control mechanisms for all areas surrounding the buildings for extended or prolonged Construction periods. To be confirmed with every scope.
- .2 Traffic control Measures shall be based on “Ontario Traffic Manual, Book 7 - Temporary Conditions”, mainly:
 - .1 Through competent and trained flag personnel.
 - .2 By continually maintain traffic control devices in use.
 - .3 By maintaining and providing signs, flashing warning lights and other devices required to indicate construction activities or other temporary and unusual conditions resulting from Project.

01 56 00 Temporary Barriers and Enclosures

Barriers

- .1 Provide secure railings and barricades to protect public and keep them safe from working areas.

01 74 00 Cleaning

- .1 Operations and maintenance manuals to contain operational information on equipment, cleaning and lubrication schedules, filters, overhaul and adjustment schedules and similar maintenance information. Instruction in this manual shall be in simple language so as to guide FMP in the proper operation and maintenance of building components.
- .2 Co-ordinate move-in and cleaning through FMP to work with the building occupants and end users.
- .3 Final cleaning will be done to FMP’s satisfaction before substantial completion can be approved.

01 74 19 Waste Management and Disposal

Carleton University has set a target to achieve a waste diversion rate of 60% across all operations. To ensure that we continue to meet this target, Carleton aims to ensure that all opportunities for minimizing waste and maximizing diversion are pursued for all construction and renovation jobs.

Large construction and renovation projects

- .1 Any contractor that works at Carleton on a project above 2,000 square meters is required by O. Reg.102/94, to conduct a Waste Audit before starting the work. This audit shall cover the waste that will be generated in the project and the extent to which materials or products used consist of recycled or reused materials or products. After the audit, the contractor shall prepare a written report of the Audit.
- .2 The contractor shall also prepare a written Waste Reduction Work Plan based on the Waste Audit, to reduce, reuse and recycle waste generated in the project. This report shall be communicated to workers at the site and must be completed before construction or renovation work begins. Both the Waste Audit and Reduction plan shall be passed on to Carleton.

All projects

- .1 In addition, all contractors shall complete a Waste Management Success Measurement Report. This shall contain a summary of the weight of the materials that were actually generated through the project, including a summary of materials that were reduced, reused and recycled. This report should be produced within 1 month of the completion of the project.
- .2 Quantitative information needed for the Waste Management Success Measurement Report should be obtained from the tracking sheets/weigh bills. Please note that the General contractor is responsible for providing records for any sub-contractor they use, and is to incur any associated costs in their quotation.
- .3 If the job is large enough to have a dedicated waste bin than the contents of this bin must be separated at the landfill or waste transfer site into the various categories. Carleton requires a copy of the weigh bill that shows the breakdown for all of the waste from the bin to be included with the Waste Management Success Measurement Report.
- .4 If there is no dedicated waste bin for the job, there is still a requirement to receive a weigh bill for the waste that is generated for any work done at Carleton. This could be a weigh bill from a recycling company for metal and/or a weigh bill showing a mixed trailer load of material that went to a disposal facility and how it was separated.
- .5 Please note that Final Payment will not be released until all waste records have been provided.
- .6 Links: Ontario Regulation 102/94 - http://www.elaws.gov.on.ca/html/regs/english/elaws_regs_940102_e.htm
- .7 Refer to General Requirements APPENDIX B - Waste Management Success Measurement Report

01 77 00 Closeout Procedures and Submittals

Closeout procedures must be carried out in compliance with [Carleton University Closeout Requirements](#).

01 79 00 Demonstration and Training

The training requirements shall be outlined in the issued for construction documents and/or Commissioning Plan. The commissioning agent and or Engineer shall coordinate with the contractor and Carleton University to develop a suitable schedule. The commissioning agent or engineer shall witness.

01 91 13 General Commissioning Requirements

In the general the commissioning process at Carleton University shall be in accordance with

- ASHRAE Standard 202 Commissioning Process for Buildings and Systems

The following requirements are intended to outline the specific requirements of Carleton University further to the above noted standards.

The Commissioning Agent shall be engaged by Carleton University as early as possible during the project design development phase. The Commissioning Agent shall report to the University's Project Manager and the Director of Energy and Sustainability.

Design Reviews:

The Commissioning Agent shall perform design reviews of the mechanical and electrical drawings and specification during the design development. Typically for larger project, design reviews would be conducted at the 30%, 60% and 99% completion stages. All design review comments shall be compiled in a report to be submitted to the design team and Carleton University. The design team shall be responsible to address the comments provided.

Commissioning Specifications:

The Commissioning Agent shall prepare the commissioning specification sections for the mechanical and electrical systems. These specifications sections shall be included in the front end of the project specifications and the Commissioning Agent shall coordinate with the design team. The commissioning specifications shall be project specific and shall clearly state the responsibilities of the Carleton University, Design Team and the General Contractor during the commissioning process.

01 91 13.13 Commissioning Plan

Prior to the start of any commissioning activities during construction, the Commissioning Agent shall prepare and submit the Commissioning Plan. The Commissioning Plan will be reviewed by the commissioning team.

The Commissioning Plan shall include:

- Commissioning Team Members
- Communication Protocol
- Roles and Responsibilities for Team Members
- Systems to be Commissioned
- Overview of the Commissioning Process
- Seasonal Commissioning Process
- Installation Verification Forms
- Performance Verification Forms
- Project Reporting & Issues Log
- Training Requirements

The Commissioning Plan shall be submitted to the commissioning team for review and shall be updated throughout the construction phase.

Commissioning Meetings:

The Commissioning Agent shall chair and minute the commissioning meetings. An initial commissioning kick-off meeting shall be scheduled once the Commissioning Plan has been submitted. Regular commissioning meetings shall be scheduled as required to suit the construction progress.

Project Reporting and Issues Log:

All commissioning activities onsite shall be documented in regular commissioning reports. The frequency of the commissioning reports shall be dependent on the project schedule and the ongoing commissioning activities. In general, a report should be provided for each site visit to document the commissioning activities which took place.

An Issues Log shall be maintained by the commissioning agent and shall be updated and submitted to the commissioning team on a regular basis. The Issues Log shall be used to document the issues noted during the commissioning activities including installation and performance verification and shall also record the remedial action taken to resolve the issue. The Issues Log shall clearly indicate the responsible party for each issue.

Installation Verification:

The Installation Verification or Static Verification forms shall be developed by the commissioning agent and shall be included in the Commissioning Plan for review by the commissioning team. The contractor shall be responsible for completing all Installation Verification forms and submitting the forms to the commissioning agent prior to starting-up the equipment. The commissioning agent shall compile the forms for inclusion in the Systems Manual.

The Installation Verification forms shall be project specific and shall be based on the requirements of the construction documents. The forms shall include:

- Equipment Nameplate Information (ex. Model number, serial number, etc.)
- Location
- System Served
- Documentation Submitted
- Equipment Condition
- Accessibility
- Serviceability
- Adherence to Construction Documents

Any issues noted in the Installation Verification forms shall be compiled and recorded on the Issues Log by the commissioning agent.

For building envelope systems, provide documentation of components, materials utilized and locations for the following: (only required if building envelope commissioning is required)

- Below or at grade systems (including damproofing, substrate, draining system and insulation)
- Wall systems
- Fenestrations (including windows, curtain vales, skylights)

Division 01 – General Requirements

- Roof Assembly
- Entrance Systems (including swing door, revolving door, overhead, roof hatch, etc.)

Performance Verification:

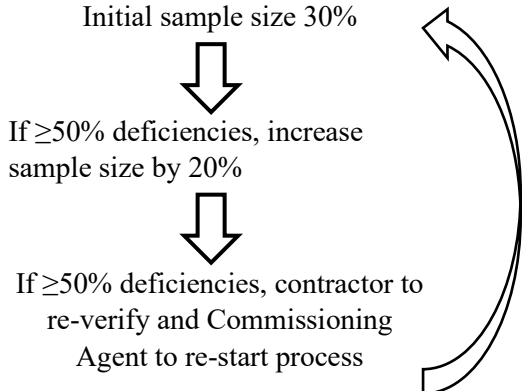
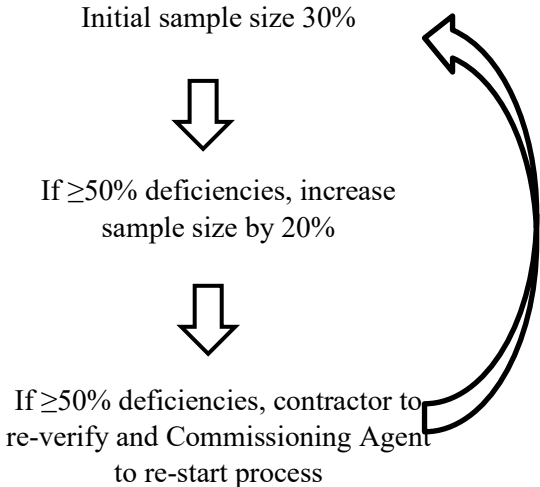
The Performance Verification forms shall be developed by the commissioning agent and shall be included in the Commissioning Plan for review by the commissioning team. The performance verification shall complete to ensure the equipment/system meet the functional and operational requirements of the construction documents. The verification procedure shall be developed to verify the function of the entire system and not simply individual pieces of equipment. The controls sequence of operations shall be based on the sequence provided in the controls shop drawings and reviewed by the design team.

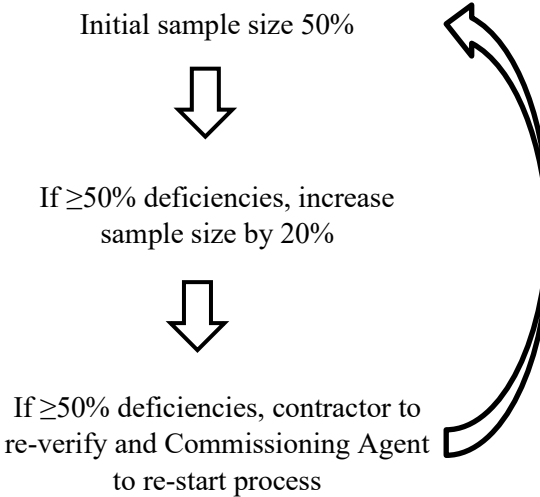
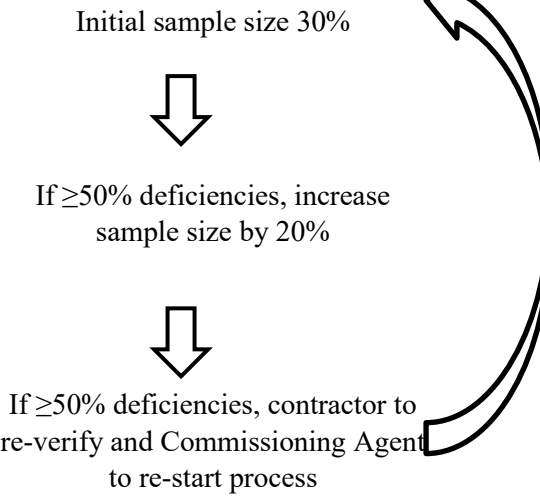
The contractor shall complete the performance verification activities as described in the performance verification forms. The commissioning agent shall witness and provide direction during the performance verification. The commissioning agent shall record the performance verification using the form.

Any issues noted during the performance verification shall be compiled and recorded on the Issues Log by the commissioning agent.

Required Sample Size:

The table below indicates the required sample size for each type of equipment to be used when completing the performance verification.

Equipment	Sample Size
Air Handling Units	100%
Rooftop Units	100%
Boilers	100%
Chillers	100%
Cooling Towers	100%
Vacuum Pumps	100%
Air Compressors	100%
Humidifiers	100%
Pumps	100%
Heat Exchangers	100%
Generators	100%
Lighting Controls	<p>Initial sample size 30%</p> <p>↓</p> <p>If $\geq 50\%$ deficiencies, increase sample size by 20%</p> <p>↓</p> <p>If $\geq 50\%$ deficiencies, contractor to re-verify and Commissioning Agent to re-start process</p> 
Fans ($\geq 3/4$ HP)	100%
Fans ($\leq 3/4$ HP)	<p>Initial sample size 30%</p> <p>↓</p> <p>If $\geq 50\%$ deficiencies, increase sample size by 20%</p> <p>↓</p> <p>If $\geq 50\%$ deficiencies, contractor to re-verify and Commissioning Agent to re-start process</p> 
Fan Coil Units (Small Project < 20 units)	100%

Equipment	Sample Size
Fan Coil Units (Large Project ≥ 20 Units)	<p>Initial sample size 50%</p> <p>↓</p> <p>If $\geq 50\%$ deficiencies, increase sample size by 20%</p> <p>↓</p> <p>If $\geq 50\%$ deficiencies, contractor to re-verify and Commissioning Agent to re-start process</p> 
Laboratory Terminal Units	100%
Fumehoods	100%
University or Tenant equipment with BAS monitoring (ex. -80 Freezer)	100%
Terminal Units (Small Project < 20 units)	100%
Terminal Units (Large Project ≥ 20 Units)	<p>Initial sample size 30%</p> <p>↓</p> <p>If $\geq 50\%$ deficiencies, increase sample size by 20%</p> <p>↓</p> <p>If $\geq 50\%$ deficiencies, contractor to re-verify and Commissioning Agent to re-start process</p> 

Integrated System Test:

When required by Carleton University, an Integrated System Test shall be performed. The Integrated System Test shall be used to verify the interoperability of the systems in a building under normal, power failure and fire alarm conditions. The Commissioning Agent shall develop the Integrated System Test procedure based on the construction documents. The Integrated System Test shall be performed by the contractor once all Functional Verification work has been completed.

Occupancy and Operations Phase

Training:

The training requirements shall be outlined in the Commissioning Plan. The commissioning agent and or Engineer shall coordinate with the contractor and Carleton University to develop a suitable schedule. The commissioning agent and or Engineer shall witness.

Seasonal Commissioning:

Commissioning agent shall prepare the seasonal performance test program and conduct the tests with assistance from the contractors, once during the first month of building operation, once during the third month of building operation, once between the fourth and tenth months in a season opposite to the first or third month visit.

Systems Manual:

Commissioning agent shall compile a Systems Manual that consists of the following: Design Narrative or Basis of Design (by design team); final commissioning plan, completed installation verification forms, completed performance verification forms, training records.

01 91 13.16 Commissioning Forms

Commissioning forms shall be developed by the commissioning agent for review by Carleton University

The commissioning agent shall develop and maintain an up to date tracking sheet for commissioning activities. As minimum, the tracking sheet shall include the following fields:

- Equipment Identification
- Equipment Type
- Installation Verification form completion status
- Start-up completion status
- Performance Verification completion status
- Training completion status
- Seasonal Verification completion status

Division 03 – Concrete

All new construction and renovation projects on Carleton University campuses are required to meet the Carleton University Facilities Design Guidelines. Including from the initial planning and design stages through to the various phases of construction and facilities maintenance and management. They are to mirror planning, design, construction, maintenance, and other facilities supporting University personnel. These documents are to be used as a guideline only on all Carleton University projects and are not to be used for bidding, permitting construction, or any other purpose. Any changes or substitutions must be approved by Carleton University Facilities Management and Planning (CUFMP) and must be submitted in writing. This document is the property of Carleton University. Any use of this document, in part or in whole, for purposes other than a Carleton University project cannot be done without written permission from the University.

Table of Contents

03 30 00 – Cast-In-Place Concrete and Steel Deck 3

03 30 00 – Cast-In-Place Concrete and Steel Deck

General

Design Criteria and Notes:

- .1 General:
 - .1 Unless project or design specifies, limit roof deflection due to specified live load to 1/360 of span. Limit floor deflection due to specified total load to 1/240 of span.
 - .2 Design to mitigate vibration caused by mechanical equipment.
- .2 Concrete:
 - .1 Concrete floors to be designed in accordance with CAN/CSA-A23.1 – 27.3.
 - .2 Exposed concrete:
 - .1 Architectural concrete finishing to be approved by CUFMP.
 - .2 Ensure that exposed concrete surfaces are dense, even, uniform in color, texture and distribution of exposed aggregates, free from defects such as honeycombing, voids, loss of fines, visible flow lines, cold joints, excessive bug holes, inadequate cover to reinforcement and incorrect tie holes, spacers, reglets, formwork joints or construction joints.
 - .3 Ensure that exposed concrete members have sharp accurate definitions of corners, reglets, etc. and are free from chips and spalls.
 - .4 Failure to meet all the above requirements shall be cause for rejection at the discretion of CUFMP.
 - .3 Only use corrosion coated materials on reinforcement.
 - .4 For exposed prefabricated concrete units, on site patching for concrete is not permitted without approval of CUFMP.
 - .5 Slab-on-grade:
 - .1 Provide construction joints in both directions. Maximum spacing of 30m with sawcut in between spaced at 30 times slab thickness max, but not more than 5m max. Locate joints in column center lines whenever possible and on intermediate lines, and as best recommended practices.
 - .2 Extensive cracking or cracks in excess of 3mm in width shall be cause for rejection at the discretion of CUFMP.
- .3 Steel:
 - .1 Structural steel floors to be designed in accordance with CAN/CSA-S136.
 - .2 Provide flashing at columns and points of discontinuity to prevent leakage of mortar when concrete is placed over deck.
 - .3 Provide edge forming for concrete slabs over deck.
 - .4 Exercise particular care in erection of exposed deck. Sections which are dented, damaged or perforated by welding will not be accepted.
 - .5 Where deck slopes steeply, fasteners may be substituted for welding of deck to support 03 45 00 - Architectural Precast Concrete

General

Extended Warranty:

- .1 Precast architectural elements shall be guaranteed from spalling or show visible evidence of cracking or any deterioration, and shall meet the design criteria and protect the building against air and water infiltration for a period of 5 years.

Design Criteria and Notes:

- .1 Panels to be sealed by double caulking lines with vented cavity, drained to the exterior with tubular vents.
- .2 Anchors for Precast elements to be generally in hot dipped galvanized steel. Use stainless steel polished Finish #2B (Grade 316) for below grade use.

Products:

Precast Panels

- .1 **Precast Concrete Insulated Sandwich Panels:**
 - .1 Composed of an outer skin of 125 mm (5") thickness and inner skin of 76 mm or 102mm (3" or 4") thickness, and 76 mm (3") thick or more rigid **Polyisocyanurate Board Wall Insulation (07 20 00)** in between, with interior joints and exposed ends of insulation board sealed.
 - .2 The two concrete skins to be held together by means of stainless steel ties.
 - .3 On the perimeter of sandwich panels, provide 200 mm (8") extension of vapour barrier on rear of insulation using **Modified bitumen, air/vapour barrier sheet (07 1000)**, turn and glue it to the insulation and concrete surfaces.
 - **Suggested (or equivalent) Product:**
 - .1 Permacon Group Inc.

Accessories:

- .1 **Tube Vent:** Tube in UV stabilized polypropylene, used in the mortar joints of block or brick wall for allowing water to flow from behind the substrate.
 - **Suggested (or equivalent) Product, as manufactured by:**
 - .1 Hohmann & Barnard (Dur-O-Wal) Limited.
 - .2 Muphco Limited.

Division 04 – Masonry

All new construction and renovation projects on Carleton University campuses are required to meet the Carleton University Facilities Design Guidelines. Including from the initial planning and design stages through to the various phases of construction and facilities maintenance and management. They are to mirror planning, design, construction, maintenance, and other facilities supporting University personnel. These documents are to be used as a guideline only on all Carleton University projects and are not to be used for bidding, permitting construction, or any other purpose. Any changes or substitutions must be approved by Carleton University Facilities Management and Planning (CUFMP) and must be submitted in writing. This document is the property of Carleton University. Any use of this document, in part or in whole, for purposes other than a Carleton University project cannot be done without written permission from the University.

Table of Contents

04 80 00 – Masonry and Stone Work	3
---	---

04 80 00 – Masonry and Stone Work

General

Design Criteria and Notes:

- .1 Do not select a masonry or stone of unit face design, colour, size or shape that will be difficult or impractical to duplicate at a later date, for renovations or future additions.
- .2 Do not sandblast exterior masonry as a restoration process.
- .3 Install movement joints of 16mm as by best recommended practices, and at:
 - a. At all junctions with structural columns.
 - b. At connection between existing and new partitions.
 - c. At intersection between main & intersecting partitions.
 - d. At intervals @ ± 7620 mm o/c, and as recommended.
- .4 Top course of concrete masonry partitions or walls, to be 100% solid or filled with mortar.
- .5 Exposed concrete masonry units used as internal partitions shall have rounded corners at intersections.
- .6 Allow tolerances for structural deflection on top of non-load-bearing partitions, to prevent transmission of structural loads to studs. Coordinate with Structure.
- .7 Fasteners and support for masonry, stone cladding or similar to be generally in hot dipped galvanized steel. Use stainless steel polished finish #2B (Grade 316) for below grade use.
- .8 Jointing of exterior cladding masonry units to be concave, flush, vee or weathered. No beaded, extruded, racked, or struck joints will be acceptable.

Products:

Masonry and Stone Units

1. Manufactured Stone Masonry Units: As per CSA A165, of modular metric.
 - Suggested (or equivalent) Products: As manufactured by Permacon.
2. Natural Stone Masonry: As per ASTM C615, Granite, 32mm (1¼") thick slabs, square edges.
 - Suggested (or equivalent) Products, as manufactured by Milestone Marble & Granite.
3. Clay Brick: As per CAN/CSA-A82.1, of modular metric.
 - Suggested (or equivalent) Product, as manufactured by:
 - .1 Belden Brick
 - .2 Canada Brick
4. Concrete Masonry Units: Regular or reinforced conforming to CSA A165, or ASTM C90 Type 1, grade N-1, heavy or lightweight, cured with low pressure steam curing, with the following characteristics:
 - .1 Hollow concrete block: Type H/15/A/M.
 - .2 Solid concrete block: Type S/25/A/M
 - Suggested (or equivalent) Products, as manufactured by (in Ontario):
 - .1 Permacon
 - .2 Boehmers

- .3 Atlas Block
- .4 Niagara Block Inc.

Mortar and Grout

- .1 Mortar Type "N" (for exterior Masonry): Pre-blended, natural color of ingredients.
 - Suggested (or equivalent) Product: "Betomix Plus" by Daubois Inc.
- .2 Mortar Type "S" (for interior Masonry): Pre-blended, natural colour of the ingredients.
 - Suggested (or equivalent) Product: "Blocmix" by Daubois Inc.
- .3 Mortar Type "O" (for restoration and historical buildings): Pre-blended, natural colour of the ingredients.
 - Suggested (or equivalent) Product: "Blocmix" by Daubois Inc.

Accessories

- .1 Cavity Drainage Material: Free-draining mesh made from polymer strands or extruded polypropylene formed cavity units to suit cavity depth, that will not degrade within the wall cavity.
 - Suggested (or equivalent) Products:
 - .1 "Mortar Break" by Advanced Building Products Inc.
 - .2 "Mortar Net" by Mortar Net USA, Ltd.
- .2 Compartmentalization Dividers: Formed 28 gauge Type 304 stainless steel sheet metal.
Sealant: One component elastomeric chemical curing.
- .3 Prefabricated Weep Holes & Vents: Full height of masonry unit, custom lip brick profile, designed to keep weep hole open for passage of air and water, UV stabilized polypropylene.
 - Suggested (or equivalent) Products:
 - .1 "Cell-Vent" by Blok-Lok Limited.
 - .2 "343 Weep Hole" by Blok-Lok Limited.
- .4 Brick Masonry Ties: Hot dip galvanized, adjustable wall ties, rectangular type, double pinned, to tie brick or exterior block work to substrate wall.
 - Suggested (or equivalent) Product: "HB-200/DA-213-HS" by Hohmann & Barnard Inc.
- .5 Cavity Drainage Mat: Fluid conducting, non-absorbent, mold and mildew resistant polymer mesh consisting of 100% recycled plastic with binder to be a non-woven textile product in random pattern and have voids no greater than 6mm in diameter.
 - Suggested (or equivalent) Product: As manufactured by Cav Clear.

Division 05 – Metals

All new construction and renovation projects on Carleton University campuses are required to meet the Carleton University Facilities Design Guidelines. Including from the initial planning and design stages through to the various phases of construction and facilities maintenance and management. They are to mirror planning, design, construction, maintenance, and other facilities supporting University personnel. These documents are to be used as a guideline only on all Carleton University projects and are not to be used for bidding, permitting construction, or any other purpose. Any changes or substitutions must be approved by Carleton University Facilities Management and Planning (CUFMP) and must be submitted in writing. This document is the property of Carleton University. Any use of this document, in part or in whole, for purposes other than a Carleton University project cannot be done without written permission from the University.

Table of Contents

General..... 3

05 21 00 - Steel Joist Framing 3

05 31 00 - Steel Decking..... 3

05 50 00 - Metal Fabrications 3

05 10 00 - Metal Stairs and Ladders..... 4

General

Design Criteria and Notes:

- .1 The maximum deflection allowed shall be $L/720$ for the stud system.

Products

Support System

- .1 Exterior Structural Steel Stud System, Galvanized: Cold rolled steel studs per CSA S136, fabricated from galvanized zinc coated steel. Depth and thickness as per structural calculations, including stud top and bottom tracks, metal furring and similar.
 - Suggested (or equivalent) Product: As manufactured by Bailey (BMP) Ltd.

Sheathing

- .1 Glass mat exterior gypsum wall sheathing board: 12.7mm (1/2") or 15.8 mm (5/8") thick as necessary, ends square cut.
 - Suggested (or equivalent) Product:
 - 1) "Dens-Glass Gold Gypsum Sheathing" and "Dens-Glass Gold Fireguard Gypsum Sheathing" by Georgia-Pacific.
 - 2) "GlasRoc Exterior Sheathing", by CertainTeed Canada
- .2 Lightweight concrete board: Exterior grade cement board, 12.7 mm (1/2") or 15.8 mm (5/8") thick as necessary, manufactured with a lightweight polymer modified cement core and fully embedded alkali resistant fiber glass facings, with tapered edges and square butt ends.
 - Suggested (or equivalent) Product: "Permabase" by Unifix.

05 21 00 - Steel Joist Framing

- .1 Detail conditions where the joist web is disrupted by other components.

05 31 00 - Steel Decking

- .1 Require mechanical clinching of decking with male/female deck side laps.
- .2 Require a sheet metal dam at deck ends where concrete is placed over the metal deck.
- .3 Require zinc oxide primer touch-up at fusion welded deck attachment.

05 50 00 - Metal Fabrications

Design Criteria and Notes:

- .1 Detail and fabricate balustrades / handrails as per National Association of Architectural Metal Manufacturers (NAAMM) Metal Stairs Manual. Design Load criteria shall be as per **OBC**.
- .2 Work shall be true to detail, clean, straight, with sharp profile and smooth finish surfaces. No material containing plugged or filled holes is permitted.
- .3 Use hot dipped galvanized fasteners and anchors for galvanized items, and stainless steel fasteners and anchors for stainless steel and aluminum items.
- .4 Use self-tapping shake-proof flat headed screws on items requiring assembly by screws and countersunk

Division 05 – Metals

exposed fastenings, cut off bolts flush with nuts for exposed item.

- .5 Install support at hang-on countertops perimeter with miscellaneous steel 'C' or 'L' channel, minimum 76mm (H) X 51mm (W) structurally anchored to the walls.
- .6 Grind welds smooth and flat, and fill flush with filler compatible with the finish coating system, where exposed to view.
- .7 Allow for differential movements with assemblies and at junctions of assemblies with the surrounding of work.
- .8 Insulate between dissimilar metals or between metal and masonry and concrete with bituminous paint to prevent electrolytic action.
- .9 Finishes:

<u>Elements:</u> Handrails, guardrails, decorative columns, wall panels, treads, stairs and similar, or as indicated.	S.S., Grade 316L		S.S., grade 304	Aluminum	Powder coated (pre painted) & hot dipped galvanized	Hot dipped galvanized steel	Primed steel	FRP
	Polished finish #2B	Fine satin finish #4						
<ul style="list-style-type: none"> • High corrosive areas. • CL3 classified laboratories. 	X							X
<ul style="list-style-type: none"> • <u>Countertops and sinks (22 42 01).</u> 	X							
<ul style="list-style-type: none"> • Exterior or interior elements in contact with exterior grade or on ground floor level close to entrance lobbies. 		X		X	X			
<ul style="list-style-type: none"> • Mechanical spaces. 							X	X
<ul style="list-style-type: none"> • Elsewhere exterior, roofs and similar. 						X		X
<ul style="list-style-type: none"> • Elsewhere interior. 			X	X			X	X

05 10 00 - Metal Stairs and Ladders

1. Steel grating, treads & landings, antiskid:
Composed of bars 38 mm x 5 mm (1½" x 3/16") and rods, smooth or serrated (antiskid) surface, regular mesh.
 - Suggested (or equivalent) Product: "Type 19-W-4" by Russel Metals Inc.
2. Fiber Reinforced Polymer (FRP) grating, treads, landings, anti-skid:
In moulded gratings, 38mm thick mesh pattern, c/w anti-skid nosing.
 - Suggested (or equivalent) Product: "Duragrate Stair tread" by Fiberman Inc.
3. Steel safety ladder rungs:
In cold formed steel, 2.28 mm (0.09" / 13 ga) thick, 40 mm (15/8") wide and 28 mm (11/8") high, with 3 holes.

- Suggested (or equivalent) Product: as manufactured by Fisher and Ludlow (Harris Steel Group Inc).
- 4. Steel Checker Plates, anti-skid:
In cold formed steel, 3 mm (.13" / 11 ga) thick, sizes as indicated, with diamond shape anti-ski surface, folded to suit.
 - Suggested (or equivalent) Product: as manufactured by Mascot Steel + Tools.

Additional Notes:

1. Provide fixed metal ladders between dissimilar roof levels for maintenance personnel access.
2. Exterior bollards shall be fixed and formed with hollow pipe to be concrete-filled and top crowned or sealed weather-tight.
3. Traffic control bollards will have the ability to be removed or collapsed to allow vehicle access to restricted areas.
4. Guard rails must be present as per OBC and/or FMP Design Guidelines - safety requirements

Accessories

1. Access panels, primed steel, regular or fire resistant: Cold rolled steel access doors and panels with continuous piano hinges, with a lock, primed, with galvanized steel corners, regular or fire rated and insulated.
 - Suggested (or equivalent) Products: as manufactured by Cendrex:
 - .1 "AHD" model (regular), for masonry walls.
 - .2 "AHD GYP" model (flush), for gypsum walls and ceilings (metal faced).
 - .3 "AHA GYP" model (recessed), for gypsum walls and ceilings (gypsum or tile faced).
 - .4 "PFI" model (fire rated and insulated).
2. Tactile Walking Surface Indicators, in Iron: In Iron - with asphalt dip. Cast-in place, or inserted.
 - Suggested (or equivalent) Product: As manufactured by Duralast.
3. Tactile Walking Surface Indicators, in Polymer: In engineered polymer composites - reinforced with fiberglass, and integral colour. Cast-in place, or inserted.
 - Suggested (or equivalent) Product: As manufactured by Kinesik Engineered Products.
4. Carborundum anti-skid strips: Manufactured from a choice of 1.6mm galvanised metal, Stainless Steel or Aluminium, coated with a mix of two-part acrylic polyurethane and aluminium oxide granule.
 - Suggested (or equivalent) Product: As manufactured by Floorsafe Inc.

Division 06 – Wood, Plastics and Composites

All new construction and renovation projects on Carleton University campuses are required to meet the Carleton University Facilities Design Guidelines. Including from the initial planning and design stages through to the various phases of construction and facilities maintenance and management. They are to mirror planning, design, construction, maintenance, and other facilities supporting University personnel. These documents are to be used as a guideline only on all Carleton University projects and are not to be used for bidding, permitting construction, or any other purpose. Any changes or substitutions must be approved by Carleton University Facilities Management and Planning (CUFMP) and must be submitted in writing. This document is the property of Carleton University. Any use of this document, in part or in whole, for purposes other than a Carleton University project cannot be done without written permission from the University.

Table of Contents

06 05 73 - Wood Treatment.....	3
06 08 99 - Rough Carpentry for Minor Works	3
06 10 53 - Miscellaneous Rough Carpentry	3
06 20 00 - Finish Carpentry	3
06 40 00 - Architectural Woodwork.....	3
06 40 23.13 - Plastic Laminate Finishing for Interior Architectural Woodwork	3
06 41 93 - Cabinet and Miscellaneous Hardware	4

06 05 73 - Wood Treatment

- .1 Specify pressure treated lumber and plywood for below grade and roofing applications.
- .2 Application of Pentox green preservative treatment is required for wood products installed immediately above grade, at locations subject to moisture, and all lumber and plywood associated with roofing and flashing details. All site cut ends must be brush treated.

06 08 99 - Rough Carpentry for Minor Works

- Salvaged framing materials shall not be reused.

06 10 53 - Miscellaneous Rough Carpentry

- Salvaged framing materials shall not be reused.

06 20 00 - Finish Carpentry

- .1 Detail and specify attachment hardware associated with finish carpentry work. Consultant to provide complete detailed drawings for the construction millwork component.
- .2 Preferred for any wood to be FSC certified.

06 40 00 - Architectural Woodwork

- .1 Detail millwork on drawings and specify associated finish hardware.
- .2 Specify attachment devices associated with cabinetwork.
- .3 Consultant to provide complete detailed drawings for the construction millwork component.
- .4 Specify low maintenance, high durability finishes. Preference for solid surfaces for long term durability.
- .5 Ensure that accessibility is integrated into the design of all architectural woodwork.

06 40 23.13 - Plastic Laminate Finishing for Interior Architectural Woodwork

- .1 All laminate surface finishes (work surfaces, counters, transaction top, and/or table tops) must be high pressure laminate (HPL) with straight edge trims for durability. Low pressure laminate is acceptable for gables, interior finishing, modesty panels and storage. Storage tops and face fronts must be HPL.
- .2 Preference is for solid surfacing for countertops in wet areas such as kitchenettes and washrooms for durability. Solid surface products must include a minimum of 10-33% binding resin to mineral composition. Acceptable products include: Corian, Avonite, Staron and Quartz. Equivalencies are acceptable with submission of resin and mineral percentages.

06 41 93 - Cabinet and Miscellaneous Hardware

- .1 All hardware to be commercial or industrial grade at minimum (industrial grade more applicable to labs and storeroom applications).
- .2 All handles to be minimum 100 mm D shape pull for accessibility.
- .3 Cabinet locks, where applicable, to be keyed alike with minimum 2 sets of keys, unless specifically indicated otherwise by end users.

Division 07 – Thermal and Moisture Protection

All new construction and renovation projects on Carleton University campuses are required to meet the Carleton University Facilities Design Guidelines. Including from the initial planning and design stages through to the various phases of construction and facilities maintenance and management. They are to mirror planning, design, construction, maintenance, and other facilities supporting University personnel. These documents are to be used as a guideline only on all Carleton University projects and are not to be used for bidding, permitting construction, or any other purpose. Any changes or substitutions must be approved by Carleton University Facilities Management and Planning (CUFMP) and must be submitted in writing. This document is the property of Carleton University. Any use of this document, in part or in whole, for purposes other than a Carleton University project cannot be done without written permission from the University.

Table of Contents

07 10 00 – Air, Moisture, Water Protection 3

07 20 00 – Thermal Insulation 7

07 30 00 – Shingles, Roof Tiles and Covering..... 11

07 40 00 – Manufactured Siding and Cladding Panels..... 12

07 50 00 – Membrane Roofing and Parapets 15

07 80 00 – Fire and Smoke Protection 24

07 90 00 – Sealants 28

07 10 00 – Air, Moisture, Water Protection

GENERAL

Extended Warranty

- .1 The work of the whole moisture, air/vapour protection system shall be guaranteed against failure of performance, by the manufacturers and by the Subcontractor, for a period of 5 years for labour and 10 years for Materials.
- .2 Manufacturer representative shall be present at all construction phases to ensure adequate quality control on the installation.

Design Criteria and Notes

- .1 All Air barrier/Vapour retarder membranes at connections with curtain wall mullions, door or window frames and at deflection joints or similar, shall be supported by Metal Flashing and Coving, Galvanized or Pre-Painted (07 40 00) 26 ga. min. (bent and folded to suit), or similar, where the unsupported gap exceeds 13mm. Otherwise, apply Silicone Sealant Transitional Membrane, or similar at those locations.
- .2 Exterior door thresholds to be imbedded in a continuous bed of Exterior Sealant (07 90 00).
- .3 Membranes to be duplicated over irregular or dented shape supports.

PRODUCTS

Water Proofing Membranes

- .1 Hot Applied Asphalt Waterproofing Membrane: Hot applied, rubberized asphalt membrane composed of specially selected blend of refined asphalts, synthetic rubber and mineral stabilizers, solids content: 100%; thickness: 5 mm (3/16") average (dry film), with fabric reinforcement; water vapour permeance: 0.6 ng/Pa.m².s (0.01 perm) for 3 mm (1/8") wet film.

Suggested (or equivalent) Products:

- "Elasto-Seal 790-11" by Henry.
- "6125" by Hydrotech.
- "PQ 6100" by Permaquik.

With Fabric Reinforcing System: spun polyester fabric, min. 0.2 mm (8 mils) thick.

Suggested (or equivalent) Products:

- "Polyester fabric" by Henry.
- "Reemay 2016" by Hydrotech.
- "PQ 2016" by Parmaquik.

- .2 *Cementitious Waterproofing*: A special formulation powder containing organic and inorganic cementitious material, used as a slurry coating, with dry film thickness 1.5 mm (1/16") for Base coat and 1.5 mm (1/16") for Wear coat.
Suggested (or equivalent) Product: "Krystol T1" (base coat) + "Krystol T2" (wear coat) by Poly-Tech MP Inc.
- .3 *Elastomeric Waterproofing Membrane*: A modified asphalt emulsion seamless monolithic membrane using formulated polymers providing elastomeric performance.
Suggested (or equivalent) Products:
- "Roller/Brush Rubber " by Cantex, distributed by Krytex Poly-Tech MP Inc.
 - "MasterSeal® HLM 5000" by BASF.
- .4 *Self-Adhering Waterproofing Membrane*: A high-performance waterproofing barrier, SBS rubberized asphalt compound, 60 mils (1.5 mm) thick, with hydrostatic head pressures of 231 feet.
Suggested (or equivalent) Product: "Blueskin WP 200" by Henry.
- .5 *Aluminized Polyurethane Coating Waterproofing Membrane* (over Metallic surfaces): Liquid- applied, single-component, heavy duty, with have high tensile strength, tear strength and elongation, all in a viscosity grade that can be used horizontally and vertically.
Suggested (or equivalent) Product: "Vulkem 801", by Tremco.

Air Barrier Membranes

- .1 *Modified Bitumen, Air Barrier Sheet*: A self-adhered vapour permeable, water resistive air barrier membrane consisting of an engineered film and a patented, permeable adhesive technology with split-back poly-release film, with 1914 ng/Pa.s.m² (33 Perms) water Vapour permeance.
Suggested (or equivalent) Product: "Blueskin VP160" by Henry.

Air Barrier and Vapour Retarder Products

- .1 *Polyolefin Vapour Barrier Membrane* (for use under concrete slab on grade): A highly durable polyolefin sheet and a non-tacky adhesive coating, with maximum 1.7 ng/Pa.s.m² (0.03 perms) water vapour permeance.
Suggested (or equivalent) Product: "Florprufe™ 120" by Grace.

- .2 Modified Bitumen, Air/Vapour Barrier Sheet and Thru-Wall Flashing Membranes, Self-Adhesive (for general use and transition points with adjacent surfaces membrane and through-wall flashing at bottom of masonry walls or at shelf angles, and at bottom of manufactured siding walls):

Self-adhered, SBS modified bitumen membrane reinforced with proprietary glass scrim, or integrally laminated to a cross-laminated polyethylene film (thru-wall), minimum 1.0 mm (40 mil) thick, with maximum 5 ng/Pa.s.m² (0.08 perms – Method B) water vapour permeance.

Suggested (or equivalent) Products for general membrane:

- "Blueskin SA" and "Lo-Temp Blueskin SA" by Henry.
- "Soprseal Stick 1100T" by Soprema.

Suggested (or equivalent) Products for thru-wall membrane:

- "Blueskin TWF" by Henry.

- .3 Polyethylene Vapour Barrier Membrane, Fire Retardant: A highly durable polyethylene sheet 10 mills, with 1.7 ng/Pa.s.m² (0.03 perms) water vapour permeance.

Suggested (or equivalent) Product: As manufactured by Uline Inc.

- .4 Liquid Emulsion Air and Vapour Barrier Membrane: One component, liquid applied, elastomeric membrane, cold applied by trowel or spray, with maximum 5 ng/Pa.s.m² (0.08 perms) water vapour permeance.

Suggested (or equivalent) Product: "Air-Bloc 32" by Henry.

- .5 Modified Bitumen Air/Vapour Barrier Sheet Membrane, Thermofusible Grade: Thermofusible, SBS modified bitumen membrane reinforced with proprietary glass scrim, 2.5 mm (100 mils) thick, with maximum 0.2 ng/Pa.m².s (0.003 perms) water vapour permeance.

Suggested (or equivalent) Products:

- "Blueskin TG" by Henry.
- "Aquabarrier TG" by IKO.
- "Soprseal 60" by Soprema.

- .6 Latex Moisture Vapor Retarder Paint: Interior Latex combining a primer and finish in a single, fast drying coat, can be topcoated, with any compatible interior latex or alkyd product, 2.4 mils total thickness, with maximum 60.0 ng/Pa.m².s (1.0 perms) water vapour permeance.

Suggested (or equivalent) Product: "Moisture Vapor Barrier" by Sherwin-Williams.

Accessories

- .1 **Geo-Drain**: Geo-drain with a dimple core of high-density polyethylene with a non-woven needle-punched filler fabric.
Suggested (or equivalent) Product:
 - "Hydro-drain 400" by Hydro-tech (vertical surfaces).
 - "Hydro-drain 700" by Hydro-tech (horizontal surfaces)
- .2 **Drainage Board**: A polypropylene Three-dimensional polymeric core drain board with a non-woven geotextile fabric fully bonded to the top dimples of the core.
Suggested (or equivalent) Product: "Henry DB" Series by Henry.
- .3 **Silicone Sealant Transitional Membrane**: Self-supportive transitional membrane in preformed silicone elastomer extrusion set in silicone bed.
Suggested (or equivalent) Product:
 - "123 Silicone Seal Series" and "795 Silicone Building Sealant" by Dow Corning.
 - "Proglaze ETA System" by Tremco.
- .4 **Expansion Joint – Pre-Compressible**: Exposed or hidden Preformed, self-expanding foam, sealant system with Silicone pre-coated surface.
Suggested (or equivalent) Product: As manufactured by EmSeal Inc.

End of Section

07 20 00 – Thermal Insulation

GENERAL

Design Criteria and Notes

- .1 Butt joints tightly and offset vertical joints to form an unbroken thermal barrier. Use largest possible dimensions to reduce number of joints.

PRODUCTS

Rigid Insulation

- .1 Extruded Expanded Polystyrene Board Roof Insulation: Type 4, with shiplapped edges, and joints staggered, RSI = 0.88 / 25 mm (R = 5.00 / 1"), of 240 kPa (35 psi) compressive strength.
Suggested (or equivalent) Products:
 - "Celfort 350" by Owens Corning.
 - "Roofmate" by Dow Chemical.
- .2 Extruded Expanded Polystyrene Board Wall Insulation: Type 4, ship lapped edges, RSI = 0.88 / 25 mm (R = 5 / 1"), minimum compressive strength of 210 kPa (30 psi). Provide appropriate grooves where Metal furring for application with rigid insulation are used.
Suggested (or equivalent) Products:
 - "Celfort 300" by Owens Corning.
 - "Styrofoam SM" by Dow Chemical.
 - "Styrofoam XPS" by Dupont.
- .3 Extruded Expanded Polystyrene Board Wall Insulation with Modified Concrete Facing: Type 4, thickness as indicated, ship lapped edges, RSI = 0.88 / 25 mm (R = 5 / 1"), minimum compressive strength of 210 KPA (30 psi); with 6 mm (1/4") modified concrete facing.
Suggested (or equivalent) Product: "Tech-Crete" by CFI.
- .4 Polyisocyanurate Board Wall Insulation with Foil Facer: Type 1, rigid, closed cell insulation, integrally laminated to tri-laminate foil/kraft/foil facers, outside face non-reflective, inside face non perforated, without CFC, with thermal resistance: RSI value of 1.27 / 25 mm (R = 7.2 / 1"); density: 32 kg/m³ (2 lb/ft³); compressive strength: 140 KPA (20 lb/in²).
Suggested (or equivalent) Product: "AP Foil-Faced" by Johns Manville.

Sprayed Insulation

- .1 *Sprayed Polyurethane Insulation*: Foam Class 1, RSI = 1.05 / 25 mm (R = 6.00 / 1").
Suggested (or equivalent) Products:
 - "Airmetic 0223-A100" ("Heatlok 0240") by Demilec.
 - "Airmetic 0223F/A100" by Demilec (for cold weather applications).
- .2 *Sprayed or Injected Polyurethane Insulation, Portable System* (in structural members' cavities or similar): Two components, without CFCs, having a density of 28 kg/m³ (1.75 lbs/ft³), in a portable dispensing system (not in cans).
Suggested (or equivalent) Product: "Froth-Pak" by Dow Chemical.
- .3 *Polyurethane Foam Adhesive Sealant* (to fill spaces between frames and adjacent walls): Polymeric insulating sealant, without CFC's single component, low density.
Suggested (or equivalent) Product: "CF 812" by Hilti

Semi-Rigid Insulation

- .1 *Mineral Fibre Semi-Rigid Board Siding Wall Insulation, Medium Density* (for metal siding panels): Stone wool, Type 1, Class 1, RSI = 0.71 / 25 mm (R = 4.0 / 1"), 32 kg/m³ (2 lb/ft³) minimum density.
Suggested (or equivalent) Product: "Roxul Plus MB" by Roxul.
- .2 *Mineral Fibre Semi-Rigid Board Cavity Wall Insulation*: Made of stone wool, Type 2, Class 4, RSI = 0.76 / 25 mm (R = 4.3 / 1"), 72 kg/m³ (4.5 lb/ft³) minimum density.
Suggested (or equivalent) Product: "CavityRock DD" by Roxul.
- .3 *Mineral Fibre Semi-Rigid Board Insulation for Curtain Wall*: Made of stone wool, Type 2, Class 4, RSI = 0.75 / 25 mm (R = 4.2 / 1"), 56 kg/m³ (3.5 lb/ft³) minimum density.
Suggested (or equivalent) Product: "CurtainRock" by Roxul.
- .4 *Glass Fibre Semi-Rigid Board Insulation with Foil Facer*: Semi-rigid insulation laminated to FSK Vapor-retarder facer. Type 2, Class 4, RSI = 0.76 / 25 mm (R = 4.3 / 1"), 48 kg/m³ minimum density.
Suggested (or equivalent) Product: "I/S 300 – FSK Faced" by Johns Manville.

Batt & Flexible Insulation

- .1 Mineral Fibre Flexible Insulation (for deflection joints): Made of stone wool, RSI = 0.68 / 25 mm (R = 3.86 / 1"), 32 kg/m³ (2 lb/ft³) minimum density.
Suggested (or equivalent) Products:
 - For wood studs: "ComfortBatt" by Roxul.
 - For steel studs: "Roxul Plus" by Roxul.
- .2 Glass Fibre Flexible Insulation (within metal studs): RSI = 0.70 / 25 mm (R = 4.00 / 1"), of 12.58 kg/m³ (0.79 lb/ft³) density.
Suggested (or equivalent) Product: "Fiberglas Pink Insulation" by Owens-Corning.
- .3 Mineral Fibre Acoustical Batt Insulation: Friction fit type insulation, 40 kg/m³ (2.5 lb/ft³) minimum density.
Suggested (or equivalent) Product: "Acoustical Fire Batts (AFB)" by Roxul.
- .4 High Thermal Resistance Blanket (for thermal bridging points): Thin-profile (starting at 10mm), flexible semi-rigid insulation. RSI = 1.72 / 25mm (R = 9.8) compressive strength 10 psi.
Suggested (or equivalent) Product:
 - "Spaceloft" by Aspen/Aerogels.
 - "HPI-1000" by Dow Corning.

Plenum Insulation

- .1 Glass Fibre Flexible Acoustical Liner (over bulkheads & ceiling tiles): Made of fiberglass bonded with thermosetting resin.
Suggested (or equivalent) Product: "Permacote Linacoustic Standard" by Johns Manville.
- .2 Flexible Acoustical Buffer (suspended in plenums): Made of fiberglass, faced with fiberglass cloth and backed with a flame-proof foil (50mm thick), secured with metal track.
Suggested (or equivalent) Products: "Plenum Barrier Quilt", by Insul-Quilts.
- .3 Semi-Rigid Acoustical Buffer (suspended in plenums): Made of mineral wool, faced with a flame-proof foil (50mm thick), secured with metal track.
Suggested (or equivalent) Products: "Rockfon Plenum Barrier Board", by Rockfon.

Polymer & Acrylic Systems

- .1 Plaster System for Foundation Walls: High performance, polymer-modified, two-component, fast-setting, non-sag cementitious mortar. Thickness from 5 mm (3/16") to 25mm (1").

Suggested (or equivalent) Product: "SikaTop-123 Plus" by Sika.

- .2 Plaster System, on Insulation or Lightweight Concrete Boards:

- Base coat: of 5 mm (3/16") thickness (on Insulation), or 1.6 mm (1/16") thickness (on Lightweight concrete board (05 40 00)), composed of 2 parts by mass of 100% acrylic product and 1 part of Type 10 Portland cement, having after 28 days an impact resistance greater than 3.5 MPa, a compression resistance of 37.6 MPa, a tension resistance of 3.6 MPa and a bending strength of 9.3 Mpa, with joint tape at the transition points (starter mesh), and Glass Fibre reinforcing on the total surface.
- Finish coat: alkali, humidity and mildew resistant, ready mixes, 100% acrylic polymer based coating, standard light sand texture, natural grey.

Suggested (or equivalent) Products:

- For Insulation system: "Adex-HC" by Adex Systems Inc. (Groupe BAO)
- For concrete board system: "Unifix System" by Unifix Inc.

Accessories

- .1 Sound Barrier Sheet (In the Studs or though Drywall Layers): A mass loaded vinyl (MLV), to increase STC ratings of walls, floors & ceilings. Can be used in new construction and also to correct noise problems in existing spaces, 3mm or 6mm thick.

Suggested (or equivalent) Product: "Audioseal Sound Barrier" by Acoustical Solutions.

- .2 Metal Furrings, for Application With Rigid Insulation: "U" or "L" shaped, min. 0.38 mm (28 ga) thick, galvanized, for drywall installation. Use custom fabricated 0.91mm (20 ga) thick furrings of bent plate, and of similar shape for the soffit application.

Suggested (or equivalent) Products: As manufactured by:

- Owens Corning.
- Dow Chemical.

- .3 Insulation Fasteners: Soft washer and pin type, direct fasten type: polyethylene washer, corrosion resistant fastener.

Suggested (or equivalent) Product: "X-SW 60 Pins" by Hilti.

End of Section

07 30 00 – Shingles, Roof Tiles and Covering

GENERAL

Extended Warranty

- .1 The work of the whole shingle roofing system shall be guaranteed against failure of performance, by the manufacturer and by the Contractor, for a period of 20 years for labor and qualified life period for the shingles.

PRODUCTS

Shingles

- .1 Asphalt Shingles: Architectural shingles, with rectangular pattern, and auto adhesive back strips. Weight / square: 350 lbs approximate.

Suggested (or equivalent) Products:

- As manufactured by GAF Inc.
- As manufactured by CertainTeed Inc.

Underlayment

- .1 Roofing Felt Underlayment: Asphalt saturated 15, non-perforated.

Suggested (or equivalent) Product: as manufactured by BP Shingle.

- .2 Glass Fiber Reinforced Modified Bitumen Waterproofing Membrane for Roofing: 1.5 mm (60 mils) thick, with mineral granules surface; self-adhesive.

Suggested (or equivalent) Product: "Gripgard" by BP Shingle.

End of Section

07 40 00 – Manufactured Siding and Cladding Panels

GENERAL

Extended Warranty

- .1 Metal siding products furnished and installed shall be guaranteed against all defects of fabrication, installation and shall be air and watertight for a period of 5 years.

Design Criteria and Notes

- .1 Metal-to-metal fastenings and accessories shall be fabricated of the same metal, or of a metal which will not set up electrolytic action causing damage to fastenings or components, or both, under most conditions.
- .2 All fasteners for aluminum or Composite Panels work shall be stainless steel, as per manufacturer's recommendations and as per ASME B18.6.4-1999.
- .3 All exposed screws to have a neoprene washer and be painted same colour as siding.
- .4 Fasteners to be self-tapping.
- .5 In siding Aluminum panels or similar, provide weepholes to control condensation, including proper inclusion of seals, and provision for breathing, venting and drainage. Do all drilling (for weepholes, etc.) in shop, not on site. (6mm min. @ 600mm o/c).
- .6 All Flashings to be continuous with same type cleats and concealed fasteners.

PRODUCTS

Metallic Exterior Panels

- .1 Exterior Metal Siding Panels, Prepainted: as per CAN/CGSB-93.4, in galvanized prepainted steel, installed vertically, with smooth surface and interlocking edges, in metal sandwich walls or on other substrates, 0.76 mm (0.03" / 22 ga) thick or as necessary.
Suggested (or equivalent) Product: As manufactured by VicWest.
- .2 Exterior Metal Siding Panels, Galvanized: as per CAN/CGSB-93.4, in hot dipped galvanized steel, with overlapping edges, in metal sandwich walls or on other substrates, 0.76 mm (0.03" / 22 ga) min. or as necessary, with Zinc coating in Glavalum Plus.
Suggested (or equivalent) Product: "2²/3" x 7/8" Corrugated", by VicWest.

Composite Panels

- .1 Glass Fiber Reinforced Concrete Cladding Panels: composed of inorganic fibre with natural stone and cement, with glass fibre reinforcements.
Suggested (or equivalent) Product: As manufactured by Synstone.

Sub-Girts

- .1 *Galvanized Steel Sub-Girt System for Walls*: Double or triple system, in galvanized steel "Z", "L" or "U" elements, of thickness as necessary, min. 1.2 mm (cal. 18), to comply to design load specified. Interior and exterior surfaces insulated by means of polyethylene *Insulating strip for metal work, self-adhesive*.

Interior Air Barrier/Vapour Retarder Panels

- .1 *Interior Metal Liner Panels, Galvanized Or Prepainted*: in galvanized or prepainted steel, installed vertically in metal sandwich walls, with interlocking edges, 0.60 mm (0.02" / 24 ga) min. or as necessary.
Suggested (or equivalent) Product: "L-800R" or "L-800SR" by VicWest.

Finishes for Prepainted Aluminum work

- .1 *Prepainted Fluoropolymer Coating Finish for Aluminum Surfaces*: a fluoropolymer resin thermosetting coating, treated with and applied in plant, in three coats, of a total dry film thickness of 50.8 microns (2.0 mils), including primer, base coat and transparent finish coat.
Suggested (or equivalent) Product: "Duranar XL" by PPG.

Accessories

- .1 *Aluminium Flashing And Coving, Anodized*: including all accessories such as alignment bars, brackets, clips, inserts, shims, trims, fillers, sills, gutters as required, AA-5005-H14 alloy and temper, "stretcher level" quality, flat or profiled, minimum 0.81 mm (0.032" / 20 ga) min., or as necessary.
- .2 *Aluminum Flashing and Coving, Prepainted*: Alloy AA-5005-H14, "stretcher level" quality, minimum 0.81 mm (0.032"/20 ga) min., or as necessary, prepainted.
- .3 *Metal Flashing And Coving, Galvanized or Pre-Painted*: Hot dipped galvanized or powder coated, including all accessories such as alignment bars, brackets, clips, inserts, shims, trims, flashings, fillers, sills, gutters, as required, base metal minimum 0.61 mm (24 ga) min., or as necessary, same material, galvanization.
- .4 *Insect Screens, Galvanized Steel* (for all gaps bigger than 4mm): Hot dipped galvanized, 0.3 mm (0.012") diameter wire 18 x 14 mesh with 60% free area, secured to the bird-screen frame.
- .5 *Insect Screens, Aluminium* (for all gaps bigger than 4mm): 0.3 mm (0.012") diameter aluminum wire, with a stitch of 7.1 x 6.3 / cm² (18 x 16 / in²) and 44% free area, secured to aluminum frame.

- .6 Thermal Breaks: (Thermal or electrolytic break and/or water-tightness), Insulating strip for metal work, self-adhesive, in cross-linked waterproof polyethylene EVA strip with adhesive on one or both faces, depending on location and required use, 3 mm (1/8") thick.
Suggested (or equivalent) Product: "Polyethylene #2720" by Jacobs and Thomson (RCR International Inc.).
- .7 Cross-Linked Butyl Preformed Sealant (at joints between metal liners and sub girts): Of 100% solids, cross-linked butyl rubber.
Suggested (or equivalent) Product: "440 II Tape" by Tremco.
- .6 Polyethylene Foam EVA Closure Blocking (for compartmentalization): matching the siding profile, in cross-linked waterproof polyethylene (EVA).
Suggested (or equivalent) Product: As manufactured by Jacobs and Thompson (RCR International Inc.).
- .7 Thermally Broken Sub-Spacers: In ceramic, Aluminum composite, or similar, engineered to meet structural requirements.
Suggested (or equivalent) Products:
- "TCCLIP" by Engineering Assemblies.
 - "TAC Thermal Spacer" by ETG.
 - "Cascadia Clip" by Cascadia Windows & doors.
 - "Iso Clip", by Northern Facades.
- .8 Synthetic Rubber Based Industrial Sealant (concealed between overlapping panels): non- skinning.
Suggested (or equivalent) Product: "JS-773" by Tremco.

End of Section

07 50 00 – Membrane Roofing and Parapets

GENERAL

Extended Warranty

- .1 The work of the full roofing system (including, sheathing, membranes and other) shall be guaranteed against failure of performance by the Contractor for a period of 2 years, and by the Manufacturer for a period of 10 years – non-prorated - for labor and Materials.

Design Criteria and Notes

- .1 For conventional systems, roofing components shall be fully adhered, with the deck sheathing board fastened to the steel supporting structure underneath. Fully mechanically through fastened roofing membrane systems are not acceptable.
- .2 Unless cases with particular energy saving concerns, or building specifics, the use of reflective white surfaces should not be considered in the roofing system choice.
- .3 In new Buildings, structural decks shall be designed to slope toward the drains to minimize the amount of sloped insulation.
- .4 Only non-combustible supporting systems (steel studs, masonry or similar) are allowed in non-combustible buildings for parapets. Plywood is allowed as nailer substrate, provided it doesn't exceed 600mm height, and the Parapet Flashing Membrane is covered by a metal flashing (**OBC 2024, 3.1.5.3.3 & 4**).
- .5 For new constructions, Roofs to be designed to have positive slopes of 2% to the drains. Parapets to be designed with tops offering 10% slopes to the roof sides.
- .6 On steel deck, fasteners for Support boards shall be anchored against upper flute ribs. The apparent portion shall not exceed the rib depths.
- .7 Work shall be carried out in accordance with good Roofing practice and Canadian Roofing Contractors' Association (CRCA).
- .8 Install Lightweight concrete board (05 40 00) 300mm deep cement board, same thickness as adjacent described deck sheathing board on the roof perimeter of steel deck, around openings and under all curbs or accessories, for structural consolidation.
- .9 Perimeter parapets to be elevated 200mm minimum from the surface. Where the height exceeds 900mm approximate, or wherever handrails are supported on parapets, a structural reinforcement shall be provided within the supporting stud system.
- .10 Roof Vapor Barrier membrane shall be upturned against parapet framing.
- .11 All Roof penetrations to be wrapped in insulated curbs, elevated 200mm minimum from the surface.

.12 Access:

- .1 All Roof Hatches need to be installed at least 2 meters away from perimeter; otherwise, a guard rail should be installed.
- .2 Always provide access to the different roof levels with appropriate means, taking in consideration the size and type of the maintenance elements for equipment.
- .3 Protect roofing system from foot traffic damage at roof access doors, access hatches, around roof mounted mechanical and electrical equipment, and other FMP requiring maintenance access using appropriate *Traffic Elements*.
- .4 Roof anchors shall be considered in the following conditions (to be confirmed by FMP):
 - .1 High roofs or where facades are not easily accessible from grade level.
 - .2 If an equipment or other similar maintenance access is required on a roof with no guard protection.

PRODUCTS

Roof Membranes

.1 *Modified Bitumen Two-Ply Exposed Roofing Membrane, Granule Surfaced:*

Base sheet: SBS polymer modified bitumen roofing membrane, minimum 2.2 mm (90 mils) thick, with a 180 g/m² non-woven polyester reinforcement, sanded lower surface for application with mopped asphalt or adhesive, and thermofusible polyethylene covered upper surface for torch application.

Suggested (or equivalent) Products: mopping asphalt or adhesive applied:

- "Modified Plus NP180 p/s" by Henry.
- "Modiflex MP-180-FS-Base" by IKO.
- "Elastophene 180 PS" by Soprema Inc.

Top sheet: SBS minimum 4 mm (160 mils) thick, with a non-woven polyester reinforcement, thermofusible polyethylene covered back face for torch application and granular finish front face.

Suggested (or equivalent) Products, torch applied:

- "Modified Plus NP 250gT4" by Henry.
- "Torchflex TP-250-Cap" by IKO.
- "Sopralene Flam 250gr" by Soprema Inc.

.2 *Modified Bitumen Two-Ply Protected Roofing Membrane:*

Base sheet: SBS polymer modified bitumen roofing membrane, minimum 2.2 mm or 3 mm (90 mils or 120 mils) thick, with a non-woven 180 g/m² polyester reinforcement,

both faces thermofusible polyethylene covered for torch application, or bottom face sanded for mopped asphalt application, and top face with thermofusible polyethylene.

Suggested (or equivalent) Products:

Torch applied:

- "Modified Plus NP180 p/p" by Henry.
- "Torchflex TP-180-FF-Base" by IKO.
- "Sopralene Flam 180" by Soprema Inc.

Mopping asphalt or adhesive applied:

- "Modified Plus NP180 p/s" by Henry.
- "Modiflex MP-180-FS-Base" by IKO.
- "Elastophene 180 PS" by Soprema Inc.

Top Sheet: similar to base sheet, both faces thermofusible polyethylene covered.

Suggested (or equivalent) Products, torch applied:

- "Modified Plus NP180 p/p" by Henry.
- "Torchflex TP-180-FF-Base" by IKO.
- "Sopralene Flam 180" by Soprema Inc.

- .3 Hot Applied Modified Asphalt Roofing Membrane: A specially selected blend of refined asphalts, synthetic rubber and mineral stabilizers, with additives for better adhesion and low temperature flexibility, with Polyester Reinforcing sheet fabric, 0.2 mm to 0.25 mm (8-10 mils) thick.

Suggested (or equivalent) Products:

- Membrane "Elasto-Seal 790-11" with "Polyester Fabric" by Monsey Henry.
- Membrane "6125" with "Reemay 2016" by Hydrotech

Parapet Flashing Membrane:

- .1 Modified Bitumen Two-Ply Sheet Flashing Membrane, Granule Surfaced: (on parapets, curbs, other vertical exposed surfaces):

Base sheet: SBS polymer modified bitumen roofing membrane, minimum 2.5 or 3 mm (100 mils or 120 mils) thick, with a non-woven polyester (or polyester and glass) reinforcement, self-adhesive, with a thermofusible polyethylene covered upper face for torch application.

Suggested (or equivalent) Products: self-adhesive:

- "Modified Plus NP180 Tack sheet" by Henry.

- "Armourbond 180" by IKO.
- "Sopralene Flam Stick" by Soprema Inc.

Top Sheet: SBS minimum 4 mm (160 mils) thick, with a non-woven polyester reinforcement, thermofusible polyethylene covered back face for torch application and granular finish front face.

Suggested (or equivalent) Products: Torch applied:

- "Modified Plus NP 250gT4" or "NP250TUW (white)" by Henry.
- "Torchflex TP-250-Cap" by IKO.
- "Sopralene Flam 250gr" by Soprema Inc.

- .2 Liquid Flashing Membrane: For difficult to adhere situations. One-component polyurethane / bitumen resin membrane.

Suggested (or equivalent) Product: "Alsan Flashing" (imbibed in granule, for UV protection), by Soprema Inc.

Support Boards

- .1 Fibreboard Panels, Regular: With square edges, asphalt coated on both faces and all edges, 12.7 mm (1/2") min. thick or as necessary.

Suggested (or equivalent) Products:

- "Esgard High Strength" by BP Shingles (EMCO).
- "Cascades II haute performance HP" by Matériaux Cascades Inc.
- "Xpress Board HD" by Soprema

- .2 Fibreboard Panels, Sloped: high performance, with square/shiplapped edges, tapered, thickness as necessary.

Suggested (or equivalent) Products:

- "Esgard" by BP Shingles (EMCO).
- As manufactured by Matériaux Cascades Inc.

- .3 Perlite Panels, Regular and Sloped, Homogeneous, expanded perlite, blended with selected binders and fibers, with waterproof top face, 25 mm (1") thick or as necessary.

Suggested (or equivalent) Product: "Fesco" by Johns Manville.

Insulations and Related Products

- .1 Expanded Polystyrene Board Roof Insulation, with Laminated Fibreboard: Incorporating a fire retardant agent, Type II, RSI = 0.70 / 25 mm (R = 4.0 / 1"), with shiplapped edges, factory laminated by asphalt to 12.7 mm (½") fibreboard panels, Type I, RSI = 0.5/25 mm (R = 2.8/1").
Suggested (or equivalent) Product: "Izofibre" by Fransyl.
- .2 Expanded Polystyrene Board Roof Insulation, Sloped: Incorporating a fire retardant agent, Type II, RSI = 0.70 / 25 mm (R = 4.0 / 1"), having a compressive strength of 125.2 kPa (18.21 lbs/in²), with square edges.
Suggested (or equivalent) Product: "Bizolon" by Fransyl.
- .3 Expanded Polystyrene Board Roof Insulation, with Sloped Laminated Fibreboard: Incorporating a fire-retardant agent, Type II, RSI = 0.70 / 25 mm (R = 4.0 / 1"), with square edges, factory laminated by asphalt to 12.7 mm (½") fibreboard panels, RSI = 0.5 / 25 mm (R= 2.8 / 1").
Suggested (or equivalent) Product: "Bizofibre" by Fransyl.
- .4 Polyisocyanurate Board Roof Insulation Regular and Sloped: Type III class 2, rigid, closed cell, inorganic/organic felt facing, with ecological expansion agent; RSI = 1.01 / 25 mm (R = 5.7 / 1"). density: 32 kg/m³ (2 lb/ft³) ; compressive strength: 158 kPa (23 lb/in²); edges: square; flame spread/smoke developed values: less than 25. Use two layers where more than 51 mm or 63.7 mm (2" or 2½") is required.
Suggested (or equivalent) Product: "E'NRG'Y 3" by NRG Polyiso (Johns Manville).
- .5 Extruded Expanded Polystyrene Board Roof Insulation: Type 4, thickness as shown, with shiplapped edges, and joints staggered, RSI = 0.88 / 25 mm (R = 5.00 / 1"), of 240 kPa (35 psi) compressive strength; with drainage grooves on the underside where required.
Suggested (or equivalent) Products:
 - "Celfort 350" by Celfortec.
 - "Roofmate" by Dow Chemical.

Air Barrier/Vapour Retarder Membrane

- .1 Asphalt Laminated Kraft Paper Vapour Barrier: Asphalt laminated double kraft paper vapour retarder, with glass fibre yarn reinforced edges, Type 2.
Suggested (or equivalent) Products:
 - "Vapour Bloc" by Henry.
 - "Roof Retarder" by Tremco.
 - "Armourgard" by Iko.

- .2 *Organic Felt Reinforced Two-Ply Asphalt Roofing Membrane*: Organic roofing felts, asphalt saturated, perforated, No. 15 organic felts, in 5 layers (3 and 2), with Regular mopping or Modified elastomeric mopping asphalt.
Suggested (or equivalent) Product: "No.15 Asphalt Felt Perforated" by IKO Industries Ltd.
- .3 *Interconnecting Vapour Barrier Membrane, Asphalt Or Adhesive Applied*: Minimum 2.2 mm (90 mils) thick, with a non-woven 180 g/m² polyester reinforcement, with sanded faces.
Suggested (or equivalent) Products:
- "Modified Plus NP180 s/s" by Henry.
 - "Modiflex MP-180-SS-Base" by IKO.
 - "Elastophene 180 SS" by Soprema Inc.
- .4 *Modified Bitumen One-Ply Vapour Barrier Membrane, Self-Adhesive, Torch or Adhesive Applied*: (for connection between roof and wall Air/vapour-barriers membranes under parapets): to serve also as of minimum 3 mm (120 mils) thick, with a non-woven 180 g/m² polyester or 160 g/m² non-woven polyester and glass scrim reinforcement, self-adhesive, or with thermofusible polyethylene covered faces.
Suggested (or equivalent) Products: self-adhesive:
- "Modified Plus NP180 Tack Sheet" (3 mm/120 mils) by Henry.
 - "Armourbond 180" (3 mm/120 mils) by IKO.
 - "Sopralene Flam Stick" (2.5 mm/100 mils) by Soprema Inc.
- Suggested (or equivalent) Products: Torch applied:
- "Modified Plus NP180 p/p" by Henry.
 - "Modiflex MP-180-FF-Base" by IKO.
 - "Sopralene Flam 180" by Soprema Inc.

Deck Sheathing

- .1 *Glass Fibre Mat Faced, Silicone Core Gypsum Roof Sheathing Board*: A core of silicone treated gypsum, with inorganic glass mat surfaces, and non-asphaltic surface treatment of the face (primed type), 12.7 mm (1/2") min. thick or as necessary, square edges.
Suggested (or equivalent) Product: "Dens-Deck" and "Dens-Deck Prime Roof Guard" by Georgia-Pacific.

- .2 *Gypsum-Fiber Roof Board*: A high-performance, versatile board with advanced fiber- reinforced technology 9.5 mm (3/8") min. thickness or as necessary, square edges.
Suggested (or equivalent) Product: " Securock" by CGC.

Traffic Elements

- .1 *Concrete Paving Slabs*: Plain face, 610 mm x 610 mm (24" x 24") paver size, 50 mm (2") thick, natural colour, with prefabricated high density polyethylene grid-type pedestals, integral with spacer ribs, or on a layer of laminated insulation.
Suggested (or equivalent) Product: "Izodalle" by Fransyl Ltée.
- .2 *Modified Bitumen Protection And Traffic Pads*: Precut pieces of the top layer of *Modified bitumen SBS Roofing Membrane*, 915 mm (36") wide by 457 mm (18"), in contrasting colour.

Accessories

- .1 *Chemical Curb System*: 50 mm (2") pourable urethane rubber seal, with precast curb components of fireproof polymer cement or black structural urethane, as necessary.
Suggested (or equivalent) Product:
- "ChemCurb" by Chem Link.
 - "Interclip system" by Duomastic.
- .2 *Gravel Ballast*: Nonporous material, washed, free from fines, ice, snow or long splinters: well graded, well rounded, Standard Size No.3, as per ASTM D 448, 25 mm to 51 mm (1" to 2"), well graded, having a density of approximately 2643 kg/m³ (165 lb/ft³), moisture content not exceeding 0.5%, as per ASTM D 1863, or as per FM Global requirements.
- .3 *Polyethylene Film Separation Membrane*: Min. 100 micron (4 mil) thick, Type 2.
Suggested (or equivalent) Product: as manufactured by W. Ralston.
- .4 *Woven Fabric Membrane*: Woven polyolefin or polyethylene fabric, UV stabilized, water permeable.
Suggested (or equivalent) Products:
- "Fabrene V.I.E." by Dow Chemical.
 - "Fabroc 400" by Hydrotech.

- .5 Expansion Joint Trim For Roofing (at exposed joints): A combination of flexible rubber membranes supported by a closed cell foam to form flexible bellows, with two metal flanges.
Suggested (or equivalent) Product: "Expand-O-Flash" by Johns Manville.
- .6 Expansion Joint Waterproof Membrane (with high exposure to water): Exposed or hidden elastomeric expansion waterproofing joint membrane, with asphaltic based medium, glued or torched.
- .7 Butyl Flexible Membrane, Reinforced (for connection between roof and wall Air/vapour- barriers membranes where structural or expansion movement is expected): Flexible flashing membrane composed of a combination of butyl and EPDM polymers, and reinforced with polyester fabric, 1.2 mm (47 mils) thick.
Suggested (or equivalent) Product: "990-26" by Henry.
- .8 Plywood Panel, Pressure Treated, Water Resistant: as per CSA O121 and CSA O325.0, exterior grade, standard construction, with maximum moisture content of 8% at time of manufacture, pressure treated with copper alkaline quaternary, in a closed cylinder, in vacuum, to obtain a retention of 6.4 kg/cm³ of wood.
Suggested (or equivalent) Product: "NW100" by Timber Specialties (Goodfellow Inc.).
- .9 Roof Accessories & Post supports: In aluminium or as indicated, complete with the corresponding 2 mm (0.08") thick flashing assemblies and seals.
Suggested (or equivalent) Products: As manufactured by Thaler.
- .10 Roof Edge Safety Railing Systems: Modular system, with no penetration to roofing, for flat or up to 3 degrees slope roofs.
Suggested (or equivalent) Products:
- "KeeGuard" by KeeSafety.
 - As manufactured by Skyline Group.
- .11 Growing Medium: Mix of organic and inorganic materials, to retain water, and support and maintain long term life and healthy growth of plant material.
Suggested (or equivalent) Products: "Rooftop Biomix" by Landsource Organix Ltd.
- .12 Roof Drainage Board: A polypropylene Three-dimensional polyethylene core drain board with a factory laminated geotextile fabric fully bonded to the top dimples of the core.
Suggested (or equivalent) Product: "Sopradrain" by Soprema.

- .13 *Anti-Root barrier*: A woven and micro-perforated polyethylene fabric.
Suggested (or equivalent) Product: “Microfab” by Soprema.
- .14 *Tray Vegetated System*: Modular tray system c/w planters and growing medium, variable depths from 75mm to 200mm.
Suggested (or equivalent) Product: “Hybrid modular system” by Liveroof.
- .15 *Roof Hatches*: with thermally broken cover and curb, polyisocyanurate insulation (R-20+), and special EPDM gasketing.
Suggested (or equivalent) Product: “S-50TB” by Bilco.

End of Section

07 80 00 – Fire and Smoke Protection

GENERAL

Extended Warranty

- .1 Caulking work shall be guaranteed against failure for a period of 3 years.
- .2 Include coverage of repair or replacement of Firestopping materials, which fail to achieve a smoke tight or watertight seal, exhibits loss of adhesion or cohesion, or do not cure. Sealants that crack, crumble, melt, shrink, run, or stain adjacent surfaces will be considered failed.

Design Criteria and Notes

- .1 All applications of fire and smoke protection assemblies shall be as per tested assemblies UL, ULC, cUL or OBC SB-3. For assemblies not tested and rated, submit proposals based on related designs using accepted design criteria.
- .2 A particular attention shall be given to the structural deflection on top of partitions, taking in consideration the compressibility of the fire-rated stopping materials. On head of partitions, compress FRR components (Insulation and / or sealant) with maximum 30% compression to allow structural deflection above.
- .3 Pipe & ducts penetrations should be done in accordance with the Engineers specifications.
 - .1 Suggested (or equivalent) Systems including but not limited to:
 - .2 cUL HW-D-0002, cUL HW-D-0060, HW-D-0061, cUL HW-D-0091, cUL HW-D-0092, cUL HW-D-0330, cUL HW-D-0291, cUL HW-D-0264, cUL HW-D-0538, cUL HW-D-1049,,
 - .3 ULC O504. Hilti Top Track Seal CFS-TTS
 - .4 <http://www.tremcosealants.com/technical-resources/fire-systems/fire-systems-canada/fire-systems-search-results-canada.aspx#p0000-bo-cw>
- .4 A certificate, confirming the integrity of each firestopping assembly and its installation in conformity with drawings and specification standards shall be submitted.
- .5 Wherever Fire Resistant Rated (FRR) partition meets an Exterior wall or any other non-FRR Partitions, this partition shall penetrate through the core of the other Wall or Partition.
- .6 Patch damage to fireproofing caused by testing or by other trades before fireproofing is concealed, or if exposed, before final inspection.
- .7 FRR sealants and caulking products shall be in contrasting colors (preferably red) comparing to other sealants in order to facilitate the identification and inspection between rated and non- rated components (partitions, slabs, etc.).

PRODUCTS

Insulation

- .1 Mineral Fibre Fire Resistant Batt Insulation: Stone wool, Type 2, of 72 kg/m³ (4.5 lbs/ft³) density and 6.9 kPa (144 lbs/ft²) compressive strength, compressed at least 25%, of required thickness; flame spread: 0; smoke developed: 5.
Suggested (or equivalent) Products:
 - "Roxul-Safe" by Roxul Inc.
 - "Safing Insulation" by Fibrex.
 - "Firebarrier" by A/D.
- .2 Mineral Fibre Fire Resistant Pre-Cut Insulation for steel deck ribs: For top of wall with metal deck use mineral wool cut to flute configuration to perfectly fit without gaps or voids.
Suggested (or equivalent) Product: "Speed plugs CP 777" by Hilti.
- .3 Intumescent Coating: Fireproofing system, interior grade application, with topcoat as necessary for colour coding.
Suggested (or equivalent) Products:
For steel work:
 - "A/D Firefilm" by A/D Fire Protection Systems Inc.
 - "SprayFilm WB3" by Cafco.
 - "Carboline Nullifier S607" by StonCor.For polyurethane or plastic insulation and similar:
 - "Flame Seal TB-C" by FSP.
 - "Monokote Z3306", by Grace.
- .4 Cementitious Fireproofing Coating: Spray-applied material, without asbestos or mineral wool, providing high fire resistance with fast reliable application. single component. It shall have a bond strength of 16.2 kPa (339 psf) minimum, a compressive strength at 10% deformation of 68.9 kPa (1440 psf) minimum, a dry density of 240 kg/m³ (15 pcf) minimum, a flame spread of 0 and smoke development of 0, for 25 mm (1") thickness.
Suggested (or equivalent) Products:
 - "Monokote Type MK-6 or Type MK-6/HY" by Grace.
 - "Cafco 400" by Cafco.

- .5 Fire Stop Bricks: With present dimensions, In Polyurethane Foam, fire and smoke resistant, for temporary or permanent sealing of cables, cable trays and pipes in wall and floor openings.

Suggested (or equivalent) Product: “CFS-BL”, by Hilti.

- .6 Fire Stop Flute Deck Blocks: In high density rockwool stone wool, in as trapezoidal, square cut, rectangular or round sections. Could include with intumescent smoke seal facing as necessary.

Suggested (or equivalent) Product: As manufactured by AIM.

Sealants & Seals

- .1 Silicone Sealant, Fire Resistant, or Modified acrylic latex elastomer sealant, fire resistant (for sealing openings around metal conduits, pipes, and ductwork, and at wall/ceiling junctions, and similar): High performance silicone or modified latex elastomer.

Suggested (or equivalent) Products: As manufactured by:

- Tremco.
- 3M Canada.
- Hilti.

- .2 Intumescent Acrylic Sealant (for sealing openings around non-metal conduits, pipes and similar): Single-component, water-based firestop sealant that will expand to fill the voids left when combustible materials burn and deteriorate in a fire.

Suggested (or equivalent) Products: “TREMstop IA+” by Tremco.

- .3 Prefabricated Collar (for sealing openings around non-metal odd pipe sizes and similar): With a hose clamp sealing system for securing the device around the penetrating items.

Suggested (or equivalent) Products: “TREMstop D+” by Tremco.

- .4 Firestop Top Track Seal: A pre-formed firestop device in wrapped polyurethane foam.

Suggested (or equivalent) Products: “CFS-TTS” by Hilti.

- .5 Penetrable Cable Sleeve: A Re-penetrable sleeve penetrations for single and bundled cables, with resealing capacity.

Suggested (or equivalent) Products: “CP 653 BA” by Hilti.

Mortars

- .1 *Fire-Rated Mortar* (as a complete Firestop system or to close down annular spaces making penetrations easier to treat with other products): one-part, fast setting, fire resistive micro silica compound, with thermal insulation and high impact resistance.
Suggested (or equivalent) Products: “Fire Mortar” by Tremco

Wraps

- .1 *Duct Wrap* (for wrapping ducts where shaft walls or Fire-dampers are difficult to install): A flexible fire-resistant wrap, inorganic fiber blanket encapsulated with a scrim-reinforced foil. 1- 1/2" thick, 6 pcf density.
Suggested (or equivalent) Products: “Duct Wrap 614+” by 3M.

End of Section

07 90 00 – Sealants

GENERAL

Extended Warranty

- .1 All caulking and sealant shall be guaranteed against leak, crack, crumble, melt, shrink, run, lose adhesion or stain adjacent surfaces, for a period of 3 years for labour and Material.

Design Criteria and Notes

- .1 Examine joint sizes and conditions to establish correct depth to width relationship for installation of back-up materials and sealants: i.e. depth of joint = 2 times the width of joint (min. 3 mm (1/8"), max. 25 mm (1") width). Install backing rod to achieve correct joint depth and shape, with approximately 30% compression, where the joint width exceed 3mm.
- .2 Apply Sealant after painting and coating work is completed. Do not paint over sealants not manufactured to be painted.
- .3 Apply Sealant on the perimeter of the new door or vision panel frames where they come to contact with adjacent surfaces; and on existing frames, if the adjacent surfaces' finishes (walls, floors) have been modified or replaced.
- .4 Install Backing rods to support sealants where joint gaps exceed 3mm.

PRODUCTS

Exterior Sealants

- .1 Epoxidized Polyurethane Terpolymer Sealant: Non-sag, for general application for joints on Building Envelope components.
Suggested (or equivalent) Products:
 - "Dymeric 240" by Tremco
 - "Sikaflex-2c NS/SL" by Sika
- .2 Multi Cable Sleeves and Sealant: Combined thermoplastic sleeve and rubberised sealant system.
Suggested (or equivalent) Product: "Riswat" by BEELE Eng.

Interior Sealants

- .1 Siliconized Acrylic Latex Sealant: Paintable, around interior work in general.
Suggested (or equivalent) Products: "Tremflex 834" by Tremco.

- .2 *Silicone Building and Glazing Sealant*: Not paintable, for Classified Labs, Clean rooms and similar spaces.

Suggested (or equivalent) Products:

- "999-A" by Dow Corning
- "Contractors SCS1800" by GE Silicones
- "Tremsil 200" by Tremco

- .3 *Silicone Sealant, Mildew Resistant*: Not paintable, around W.C. accessories and similar items.

Suggested (or equivalent) Products:

- "786" by Dow Corning
- "Sanitary SCS1700" by GE Silicones

- .4 *Cellular Foam and Silicone Sealant*: Foam component + Silicone Sealant for expansion, dynamic joints or wide joints exceeding 25mm wide.

Suggested (or equivalent) Products: "Colorseal" by Emseal

- .5 *Smoke and Acoustic Top Track seal*: A pre-formed device in wrapped polyurethane foam.

Suggested (or equivalent) Products: "CS-TTS SA" by Hilti.

Accessories

- .1 *Polyethylene Closed Cell Foam Backing Rod*: compressible and resilient, oversized 30 to 50%.

Suggested (or equivalent) Products:

- "Ethafoam 220 Round" by Dow Chemical Co.
- "HBR" by Tremco.

End of Section

Division 08- Openings

All new construction and renovation projects on Carleton University campuses are required to meet the Carleton University Facilities Design Guidelines. Including from the initial planning and design stages through to the various phases of construction and facilities maintenance and management. They are to mirror planning, design, construction, maintenance, and other facilities supporting University personnel. These documents are to be used as a guideline only on all Carleton University projects and are not to be used for bidding, permitting construction, or any other purpose. Any changes or substitutions must be approved by Carleton University Facilities Management and Planning (CUFMP) and must be submitted in writing. This document is the property of Carleton University. Any use of this document, in part or in whole, for purposes other than a Carleton University project cannot be done without written permission from the University.

Notes to specification writers are in [blue](#).

Table of Contents

08 11 13 – Hollow Metal Doors and Frames.....	3
08 14 10 - Flush Wood Doors.....	16
08 33 00 – Overhead Doors	25
08 41 13 – Aluminum Doors and Frames.....	26
08 42 29 – Aluminum Sliding Doors.....	33
08 71 00 – Hardware Specification	40
08 50 00 – Windows.....	79
08 60 00 – Wood and Plastic Windows.....	80
08 80 00 – Glazing.....	81
08 90 00 – Glazed Curtain Walls	82

The purpose of this design guideline is to establish fundamental requirements for the specification, manufacturer, and installation of hollow metal doors and frames. The selection of hollow metal doors and frames sizes, frame profiles, door faces, door lite configurations and hardware locations for specific applications establish a variety of criteria that include fire and life safety codes, building codes, barrier free accessibility, security and electronic access control.

- *All fire-rated doors and frames will have no on-site modifications beyond certification requirements.*
- *All fire-rated doors and frames will have appropriate fire labels attached prior to leaving the supplier or manufacturers place of business. Fire labels are to at a location which is clearly visible and are not be painted over.*
- *Any hardware installations or modifications that can affect the fire rating of the openings assembly requires that Carleton Facilities Management and Planning (CUFMP) be made aware immediately and that an inspection by the fire labeling authority (example: UL – Underwriters Laboratories/ WH – Warnock Hersey) re-certify the assembly and a copy of the recertification be provided to CUFMP.*

08 11 13 – Hollow Metal Doors and Frames

Part 1 – General

.1 Summary

This Section includes commercial hollow metal products, including doors, panels, frames, transom frames, sidelight and window assemblies as shown in the contract documents.

.2 Products Provided Under This Section

- A. Commercial hollow metal doors, swinging type, including glass moldings and stops, louvers, louver inserts as shown in the approved submittal drawings.
- B. Commercial hollow metal panels, fixed or removable, flush or rabbeted, similar in construction to hollow metal doors.
- C. Commercial hollow metal frames, transom frames, sidelight and window assemblies, including glass moldings and stops, louvers, louver inserts as shown in the approved submittal drawings.

.3 Related Sections

List related sections to Hollow Metal Doors and Frames.

.4 References

List publications referenced with the most recent Standard that is available, the Specifier must verify its applicability to the Specification prior to its inclusion.

- .1 NFPA 80 – Standard for Fire Doors and Fire Windows. *Note all referenced dates of*

standards must be updated to current for construction documents.

- .2 ASTM A653/A653M-05a – Specification for Sheet Steel, Zinc Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvannealed) by Hot-Dip Process. *Note all referenced dates of standards must be updated to current for construction documents.*
- .3 ASTM C553-02 – Specification for Mineral Fiber Blanket Insulation for Commercial and Industrial Applications. *Note all referenced dates of standards must be updated to current for construction documents.*
- .4 ASTM C578-05 – Specification for Rigid, Cellular Polystyrene Thermal Insulation. *[Insert most recent year of Standards]*
- .5 ASTM C591-01 – Specification for Un-faced Preformed Rigid Cellular Polyisocyanurate Thermal Insulation. *Note all referenced dates of standards must be updated to current for construction documents.*
- .6 ASTM C592-04 – Specification for Mineral Fiber Batt and Blanket Thermal Insulation for Light Frame Construction. *Note all referenced dates of standards must be updated to current for construction documents.*
- .7 ASTM C1289-05a – Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board. *Note all referenced dates of standards must be updated to current for construction documents.*
- .8 CAN-4-S104-M80 – Standard Method for Fire Tests of Door Assemblies. *Note all referenced dates of standards must be updated to current for construction documents.*
- .9 CAN-4-S106-M80 – Standard Method for Fire Tests of Window and Glass Block Assemblies. *Note all referenced dates of standards must be updated to current for construction documents.*
- .10 CGSB 41-GP-19MA – Rigid Vinyl Extrusions for Windows and Doors. *Note all referenced dates of standards must be updated to current for construction documents.*
- .11 CSA W59 – Welded Steel Construction (Metal Arc Welding). *Note all referenced dates of standards must be updated to current for construction documents.*
- .12 CSDMA – Recommended Dimensional Standards for Commercial Steel Doors and Frames. *Note all referenced dates of standards must be updated to current for construction documents.*
- .13 CSDMA – Selection and Usage Guide for Steel Doors and Frames. *Note all referenced dates of standards must be updated to current for construction documents.*
- .14 CSDMA – Recommended Specifications for Commercial Steel Door and Frame Products. *Note all referenced dates of standards must be updated to current for construction documents.*

.5 Performance Requirements

List performance requirements.

.6 Submittals

- .1 Comply with Submittal Procedures.
- .2 Product Data: Submit manufacturer's product data, including description of materials, components, fabrication, finishes, and installation instructions.
- .3 Shop Drawings: Submit door and frame schedule, door and frame shop drawings, including elevations, sections, and details, indicating dimensions, tolerances, materials, material thickness, fabrication, doors, panels, framing, glazing, and finish.
- .4 Other Action Submittals:

Door Hardware Schedule: Prepared by or under the supervision of a qualified Architectural Hardware Consultant (AHC) or Electrified Hardware Consultant (EHC), detailing fabrication and assembly of door hardware, as well as installation procedures and diagrams. Coordinate final door hardware schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware. [Door hardware schedule must be submitted for review and approval by CUFMP three \(3\) months prior to issuing for tender.](#)

.7 Quality Assurance

- .1 Manufacturer's Qualifications:
 - a. Continuously engaged in manufacturing of doors of similar type to that specified, with a minimum of 25 years successful experience.
 - b. Door and frame components from same manufacturer.
- .2 Installer Qualifications:
 - a. An installer which has had successful experience with installation of aluminum doors and frames with the same or similar units required for the project and other projects of similar size and scope.
 - b. Minimum 5 years' experience with the installation of hollow metal doors and frames.

.8 Delivery, Storage, and Handling

- .1 Delivery: Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying opening door mark and manufacturer.
- .2 Storage: Store materials in clean, dry area indoors in accordance with manufacturer's instructions.
- .3 Handling: Protect materials and finish from damage during handling and installation.

.9 Warranty

- .1 Warrant doors, frames, and factory hardware against failure in materials and workmanship, including excessive deflection, faulty operation, defects in hardware installation, and deterioration of finish or construction more than normal weathering.
- .2 Warranty Period: Two (2) years from date of substantial completion of the project.

Part 2 – Products

.1 Hollow Metal Doors

- .1 Materials
 - a. Steel: Define manufactures recommended material for use in specific building areas and locations.
- .2 Construction
 - a. Door face sheet thickness and steel type.
 - ii. Interior low frequency cycled doors constructed of 18 gauge (0.048", 1.2mm) minimum thickness commercial quality steel sheet.
 - iii. Interior high frequency cycled doors constructed of 16 gauge (0.064", 1.6mm) minimum thickness commercial quality steel sheet.
 - iv. Exterior doors constructed of 0. 16 gauge (0.064", 1.6mm) minimum thickness commercial quality steel sheet, free of scale.
 - b. For low frequency cycled doors, join face sheets at their vertical edges by mechanically inter- locking. Tack weld at top and bottom door, above and below each edge cut out and at 6" (150mm) on center.
 - c. For high frequency cycled doors, join face sheets at their vertical edges by continuously weld extending the full height of front and back panel edges, such that there are no visible welds or weld marking on the exposed door edges, presenting a seam that is finished smooth such that it is not visible at both edges of the door. Provide steel stiffeners. Consult Carleton University representative if steel stiffeners cannot be incorporated.
 - d. Fabricate doors with minimum nominal door thickness of 1.75 in. (44 mm).
 - e. Prior to shipment mark each door with an identification number as shown on the approved submittal drawings.
 - f. Door Core Materials
 - ii. Standard Duty
 - .1 Interior Office Space Doors: honeycomb core, steel-stiffened 18-gauge

- iii. Heavy Duty
 - .1 Interior High Use Doors: hollow steel construction 16-gauge, fully-welded seams
- iv. Heavy Duty
 - .1 Exterior Doors: (other than storefront type) insulated, steel-stiffened, fully-welded 16-gauge
- v. Interior low frequency cycled doors – Stiffen doors with structural small cell 1" (25.4) maximum Kraft Paper "honeycomb". Weight: 36.3 kg (80 lb.) per ream minimum, density: 16.5 kg/m³ (1.03 pcf) minimum, sanded to required thickness
- vi. Interior high frequency cycled doors and Exterior – Stiffen doors using continuous vertically formed steel sections which, upon assembly, span the full thickness of the interior space between door faces. Fabricate stiffeners from 0.026 in. (0.6 mm) minimum thickness steel and space them so that the vertical interior webs are no more than 6 in. (152 mm) apart. Securely fasten stiffeners to both face sheets by spot welds spaced a maximum of 5 in. (127 mm) on center vertically. Fill spaces between stiffeners with loose batt type fiberglass or mineral rock wool batt-type material, density 24 kg/m³ (1.5 pcf) minimum, conforming to ASTM C553 or ASTM C592.
- vii. Where determined and scheduled by the Architect, insulate temperature rise rated (TRR) fire doors to limit the temperature rise on the "unexposed" side of the door, as required by the governing building code requirements.
- g. Close the top and bottom edges with a continuous steel channel, not less than 0.053 in. (1.3 mm) thickness, welded to both face sheets.
- h. Close flush at the top edge, interior and exterior doors, or doors where otherwise scheduled by the Architect. Where required for attachment for weather-stripping, provide a flush steel closure channel at the bottom edge. Provide openings in the bottom closure channel of exterior doors to permit the escape of entrapped moisture.
- i. Provide edge profiles on both vertical edges of doors as follows, unless hardware dictates other- wise:
 - ii. Single acting doors - beveled .125 in. (3.1 mm) in 2 in. (50.8 mm) profile
- j. Hardware Reinforcements and Preparations
 - ii. Weld all hardware reinforcements to door.
 - iii. Self-tapping fasteners are not permitted on, or for attachment of any hardware, even if supplied by hardware manufacture

- iv. Mortise, reinforce, drill and tap doors at the factory for templated hardware only, in accordance with the approved hardware schedule and templates provided by the hardware supplier.
- v. Mortise and reinforce doors for anchor hinges, thrust pivots, pivot reinforced hinges, or non- templated hardware. Drilling and tapping, by others.
- vi. Reinforce doors for surface mounted hardware or continuous hinges. Drilling and tapping, by others
- vii. Steel thickness for hardware reinforcements to be the manufacturer's standard as required to adequately support the door and hardware, but not less than:
 - i. Full mortise hinges and pivots.....0.123 in. (3.12 mm)
angle or channel shaped type.
 - .1 Lock fronts, mortised latching devices
and strikes.....0.053 in. (1.34 mm)
unitized reinforcement with extruded tapped holes that provide
equivalent number of thread as 0.093 in. (2.3 mm)
 - .2 Concealed holders and surface mounted closers.....0.093 in. (2.3 mm)
 - .3 Internal reinforcements for other
surface mounted hardware.....0.067 in. (1.7 mm)
 - viii. Where power operated hardware is indicated on the approved hardware schedule, provide access from hinge edge to device in accordance with the templates provided.
- k. Glazing Moldings and Stops
 - ii. Where specified or scheduled, provide doors with steel moldings to secure glazing materials furnished and installed in the field by others, in accordance with glazing sizes and thickness shown in the contract documents.
 - iii. Provide fixed glazing molding or integral stops, 0.032 in. (0.8 mm) minimum thickness, located on the secure side of the door, as designated on the Architect's drawings and/or door schedules.
 - iv. Fabricate channel shaped removable glazing stops not less than 0.032 in. (0.8 mm) material thickness, to be 0.625 in. (16 mm) in height, with tight fitting butt or mitered corners, and secure with #6 minimum, oval head corrosion resistant countersunk sheet metal screws.
 - v. Treat metal surfaces to which removable glazing stops are applied and the inside of the removable glazing stops for maximum paint adhesion and coat with a rust inhibitive primer prior to installation in the door.
 - vi. Prepare fire-protection rated doors for listed glazing as

required in accordance with the door manufacturer's fire rating procedure.

I. Louvers.

- ii. Provide doors with louvers where specified in the contract documents.
- iii. Louvers for non-fire-protection rated doors; welded inverted V type, Y type or Z type, face sheet pierced construction or louver inserts.
- iv. Fabricate welded inverted V, Y and Z type vanes from 0.042 in. (1.06 mm) minimum thickness steel, matching the Type and Finish of the door face sheets.
- v. Prepare fire-rated doors for listed, fire door louvers.
- vi. Provide insect and/or bird screens at louvers for exterior application doors where shown on the contract documents.

.2 Hollow Metal Panels

- .1 Hollow metal panels, 1.75 in. (44 mm) nominal thickness, of the same materials and construction as specified in Section 2.01 of this specification.
- .2 Finish hollow metal panels as specified in Section 2.06 of this specification.

.3 Hollow Metal Frames

.1 Construction

- a. Fabricate frame product as welded units of the sizes and types shown on the approved submittal drawings. Knocked-down frames are not acceptable.
- b. Profile thickness and steel type:
 - i. Interior Frame Product: Construct profiles of commercial quality galvanized steel sheets, free of scale, pitting or surface defects. Fabricate frame product from 16 gauge (0.064", 1.6mm) minimum thickness for low frequency cycled 14 gauge (0.080", 2.0mm) for high frequency cycled single door openings exceeding 4 ft. (1219 mm) in width, pairs with either door exceeding 4 ft. (1219 mm) in width and for nominal door opening height exceeding 10 ft. (3048 mm).
 - ii. Exterior Frame Product: Construct profiles from zinc coated steel sheets, free of scale, pitting or surface defects. Fabricate frame product from 14 gauge (0.080", 2.0mm) minimum thickness for single door openings exceeding 4 ft. (1219 mm) in width, pairs with either door exceeding 4 ft. (1219 mm) in width and for nominal door opening height exceeding 10 ft. (3048 mm).
- c. Hardware Reinforcements and Preparations

- i. Weld all hardware reinforcements to frame product.
- ii. Mortise, reinforce, drill and tap frame product at the factory for templated hardware only, in accordance with the approved hardware schedule and templates provided by the hardware supplier.
- iii. Mortise and reinforce frame product for anchor hinges, thrust pivots or non-templated mortised hardware. Drilling and tapping, by others.
- iv. Reinforce frame product for surface mounted hardware or continuous hinges. Drilling and tapping, by others.
- v. Minimum thickness of hardware reinforcements;
 - i. Full mortised hinges and pivots.....0.167 in. x 1.25 in. x 10 in. length (4.2 mm x 31.7 mm x 254 mm)
 - ii. Strikes.....0.093 in. (2.3 mm) or 0.053 in. (1.3 mm) unitized reinforcement with extruded tapped holes that provide equivalent number of threads as 0.093 in. (2.3 mm)
 - iii. Flush bolts, closers, hold open arms, and other surface applied hardware.....0.093 in. (2.3 mm)

d. Where power operated hardware is indicated on the Architect's drawings or approved hardware schedule, provide prepared grout guards in accordance with the templates provided. Fabricate access plates, where required, of the same material, thickness and finish as the frame product, fastened with corrosion resistant screws. Secure access plates with a minimum of four (4) #8-32 machine screws or #6 sheet metal screws, spaced at 12 in. (305 mm) on center maximum.

e. Floor Anchors

- i. Weld floor anchors inside jambs. Provide two (2) holes for fasteners supplied and installed by others under Section 09 20 00.
- ii. Where specified or scheduled, provide adjustable floor anchors with no more than 2 in. (50.8 mm) height adjustment.
- iii. For applications that do not permit the use of a floor anchor, substitute an additional jamb anchor at a location not to exceed 8 in. (204 mm) from the base of the jamb.
- iv. Thickness of floor anchor; same as frame, minimum.

f. Jamb Anchors

- i. Provide frame product with anchorage appropriate to frame and wall construction.
- ii. Masonry Type:
Provide steel adjustable jamb anchors of the strap and stirrup or T-strap type not less than 0.042 in. (1.06 mm) or 0.156 in. (4 mm) diameter wire type, for frame product to be installed in new masonry walls. Straps; 2 in. x

10 in. (50 mm x 254 mm) in size minimum, corrugated and/or perforated. Place jamb anchors at a maximum of 18 in. (457 mm) from top and bottom of openings. Minimum number of anchors, spaced at maximum of 32 in. (813 mm) on center, provided on each jamb based on the over-all frame height.

- i. Up to 60 in. (1524 mm) 2 anchors
- ii. Greater than 60 in. (1524 mm)
up to 90 in. (2286 mm)3 anchors
- iii. Greater than 90 in. (2286 mm)
up to 96 in. (2438 mm)4 anchors
- iv. Greater than 96 in. (2438 mm)4 anchors plus one for each
24in.
(610 mm) or fraction thereof, spaced at 24 in. (610 mm)
maximum between anchors

iii. Dry Wall Type

Provide steel jamb anchors of suitable design, not less than 0.042 in. (1.06 mm) thickness, welded inside each jamb for frame product installed in drywall partitions. Place jamb anchors at a maximum of 18 in. (457 mm) from top and bottom of openings. Minimum number of anchors spaced at a maximum of 32 in. (813 mm) on center, provided on each jamb, based on the over-all frame height:

- i. Up to 60 in. (1524 mm)3 anchors
- ii. Greater than 60 in. (1524 mm)
up to 90 in. (2286 mm)4 anchors
- iii. Greater than 90 in. (2286 mm)
up to 96 in. (2438mm)5 anchors
- iv. Greater than 96 in. (2438 mm)5 anchors plus one for each
24 in.
(610 mm) or fraction thereof, spaced at 24 in. (610 mm) maximum
between anchors

iv. Expansion Bolt Type

Prepare frame product for installation in existing masonry or concrete walls for expansion bolt type anchors. Provide a countersunk or dimpled hole for a 0.375 in. (9.5 mm) diameter flat head bolt and a spacer welded within the frame profile. Locate anchors a maximum of 6 in. (152 mm) from the top and bottom of the frame, with intermediate spacing at a maximum of 26 in. (660 mm) on center. Bolts and shields for such anchors provided and installed by others under Section 06 10 00.

v. Other Anchor Types

Construct and provide frame product to be installed in pre-finished concrete, masonry or steel openings, with anchoring systems of

suitable design and quantity as shown on the approved submittal drawings. Fasteners for such anchors shall be provided and installed by others under Section 03 30 00 or 04 20 00 as required.

- g. Fabricate frame product installed in masonry walls with door openings greater than 48 in. (1219 mm) in width with a steel angle or channel stiffener factory welded into the head. Provide stiffeners not less than 0.093 in. (2.3 mm) in thickness, not longer than the door opening width. Stiffeners and frame product are not to be used as lintels or load bearing members.
- h. Attach grout guards fabricated from not less than 0.042 in. (1.06 mm) thick steel at hardware mortises on frame product to be grouted.
- 9. For all door openings in frame product provide a temporary steel spreader welded to the base of the jambs or mullions to serve as bracing during shipping, and handling. ***Temporariespreader bars are not to be used for installation.***
- 10. Removable Glazing Stops
 - a. Where specified, provide frame product with removable stops to secure glazing material or in-fill panels. Glazing materials are furnished and installed in the field by others, in accordance with glazing sizes and thickness shown in the contract documents.
 - b. Fabricate removable steel channel glazing from not less than 0.032 in. (0.8 mm) thick, butted at corners and secured to the frame section using #6 minimum, corrosion resistant countersunk sheet metal screws.
 - c. Treat the frame section underneath the glazing stops and the inside of the glazing stops for maximum paint adhesion and coat with a rust inhibitive primer prior to installation in the opening.

.4 Manufacturing Tolerances

- .1 Maintain manufacturing tolerances within limits and in accordance with ANSI/NAAMM HMMA 841.

.5 Hardware Locations

- .1 The location of hardware on new doors and frame products shall match existing.

.6 Accessories

- | | |
|---------------------------------------|----------|
| A. Lock/Strike Reinforcements | 16-gauge |
| B. High Frequency Hinge Reinforcement | 10-gauge |

C. Flush Bolt Reinforcements	16-gauge
D. Reinforcements for surface applied hardware	18-gauge
E. Top and Bottom Channels	18-gauge
F. Steel Top Caps	20-gauge
G. Glass Trim	20-gauge
H. Mortar Guard Boxes	18-gauge
I. Floor anchors	16-gauge
J. Wall anchors	
-Masonry Strap Type	18-gauge
-Masonry Wire type	4.0 mm dia.
-Masonry Stirrup-Strap Type	16-gauge
-Steel/Wood Stud Type	20-gauge
-Steel/Wood Stud Tension and-associated Wall Type	20-gauge
K. Existing Masonry/Concrete Wall type:	20-gauge
L. Jamb Spreaders :	20-gauge

.7 Finish

- .1 Refer to HMMA 802, "Manufacturing of Hollow Metal Doors and Frames and HMMA 840 TN01-07 "Painting Hollow Metal Products".

Part 3 – Execution

.1 Site Storage and Protection of Materials

- .1 Responsibilities of the contractor responsible for receiving hollow metal door and frame product;
 - a. Remove wraps or covers upon delivery at the building site and ensure that any scratches or disfigurement caused by shipping or handling are promptly cleaned and touched up with a rust inhibitive 'Direct to Metal' (DTM) primer.
 - b. Ensure that materials are properly stored on planks or dunnage in a dry location. Store doors and frame product in a vertical position, spaced by blocking.
 - c. Refer to HMMA 840-07 "Guide Specification for Installation and Storage" for proper storage techniques.

.2 Installation

- .1 The installer is responsible for performing the following:
 - a. Prior to installation;
 - i. Prior to the hollow metal doors and frames are installed, the architect, contractor, consultant, hollow

- metal door and frame distributor, installer shall attend a pre- installation meeting to review installation and coordination with other work.
- ii. Check the area of floor on which the frame product is to be installed, and within the path of the door swing, for flatness and correct if necessary.
 - iii. Check doors and frame product for correct size, swing, fire rating and opening number. If product does not comply with contract documents, do not install and contact the supplier.
 - iv. Isolate and protect all interior surfaces of perimeter frame product sections to be installed in masonry or concrete walls from grout and antifreeze agents.
 - v. Remove temporary spreaders.
 - vi. Refinish to match original, any marks caused by spreader removal.
- b. During the setting of frame product check and correct as necessary for opening width, opening height, squareness, alignment, twist and plumbness. Maintain installation tolerances within the following limits.
- a. Opening Width..... measured from rabbet to rabbet at top,middle and bottom of frame + 0.0625 in (1.5 mm), – 0.0313 in (0.8 mm)
 - b. Opening Height..... measured vertically between the frame head rabbet and top of floor or bottom of frame minus jamb extension at each jamb and across the head; + 0.0625 in (1.5 mm), – 0.0313 in (0.8 mm)
 - c. Squareness..... measured at rabbet on a line from jamb, perpendicular to frame head; not to exceed 0.0625 in (1.5 mm)
 - d. Alignment..... measured at jambs on a horizontal line parallel to the plane of the face; not to exceed 0.0625 in (1.5 mm)
 - e. Twist..... measured at opposite face corners of jambs on parallel lines perpendicular to the plane of the door rabbet; not to exceed 0.0625 in (1.5 mm)
 - f. Plumbness..... measured at the jambs on a perpendicular line from the head to the floor; not to exceed 0.0625 in (1.5 mm)
- * Note that inspection of the installation may be completed by Carleton University or their representative at random times during the various phases of construction to ensure the openings are plumb, level and square.*
- c. Install labeled fire doors and frame product in accordance with the terms of their listings, ANSI/ NFPA 80 or the local Authority Having Jurisdiction.
 - d. Refer to HMMA 840-07 “Guide Specification for Installation and

Storage” for proper installation techniques of doors and frames.

.3 Clearances

- .1 Ensure that the edge clearance for swinging hollow metal doors provides for the functional operation of the assembly and does not exceed the following:
 - a. Between doors and frame product at head and jamb.....0.125
in (3.1 mm) +/- 0.0625 in (1.5 mm)
 - b. Between edges of pairs of doors.....0.125
in (3.1 mm) +/- 0.0625 in (1.5 mm)
- .2 Floor clearance for fire-protection rated swinging hollow metal doors shall not exceed 0.75 in (19.0 mm) unless otherwise directed by the Architect. Floor clearance shall be provided for the functional operation of all swinging hollow metal doors and shall not be less than 0.125 in (3.1 mm).

Disclaimer Statement

This specification guideline is intended to be used by a qualified construction specifier. The guide specification is not intended to be verbatim as project specification without appropriate modifications for the specific use intended. The specification guideline must be used and coordinated with the procedures of each design firm, and the requirements of a specific construction project.

End of Section

08 14 10 - Flush Wood Doors

The purpose of this design guideline is to establish fundamental requirements for the specification, manufacturer, and installation of flush wood doors. The selection of wood door sizes, door faces, and hardware locations for specific applications establish a variety of criteria that include fire and life safety codes, building codes, barrier free accessibility, security and electronic access control.

- All fire-rated doors and frames will have no on-site modifications beyond certification requirements.*
- All fire-rated doors and frames will have appropriate fire labels attached prior to leaving the supplier or manufacturers place of business. Fire labels are to at a location which is clearly visible and are not be painted over.*
- Any hardware installations or modifications that can affect the fire rating of the openings assembly requires that Carleton Facilities Management and Planning (CUFMP) be made aware immediately and that an inspection by the fire labeling authority (example: UL – Underwriters Laboratories/ WH – Warnock Hersey) re-certify the assembly and a copy of the recertification be provided to CUFMP.*

Part 1 – General

.1 Summary

This Section includes architectural flush wood interior door products, of ultra-heavy duty and anti-warping construction, for intensive use as shown in the contract documents.

.3 References

- .1 American National Standards Institute (ANSI): A 208.1 - Standard for Particleboard. *Note all referenced dates of standards must be updated to current for construction documents.*
- .2 ASTM International (ASTM):
 - a. ASTM D 1761 - Screw Withdrawal Test Method. *Note all referenced dates of standards must be updated to current for construction documents.*
 - b. ASTM D 5456 - Standard Specification for Evaluation of Structural Composite Lumber Products. *Note all referenced dates of standards must be updated to current for construction documents.*
 - c. ASTM E 90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions. *Note all referenced dates of standards must be updated to current for construction documents.*
 - d. ASTM E 413 - Classification for Rating Sound Insulation. *Note all referenced dates of standards must be updated to current for construction documents.*
 - e. ASTM E 1332 - Standard Classification for Determination of Outdoor-Indoor

Transmission Class. [Note all referenced dates of standards must be updated to current for construction documents.](#)

- f. ASTM E 2235 - Standard Test Method for Determination of Decay Rates for Use in Sound Insulation Test Methods. [Note all referenced dates of standards must be updated to current for construction documents.](#)
- .3 Architectural Woodwork Institute - Quality Standards or The Architectural Woodwork Institute (AWI) and The Architectural Woodwork Manufacturers Association of Canada (AWMAC). [Note all referenced dates of standards must be updated to current for construction documents.](#)
- .4 Carleton University Facility Design Guidelines Division 8 – Doors and Windows, 2018 Edition [Note all referenced dates of standards must be updated to current for construction documents.](#)
- .5 Door and Hardware Institute (DHI) – Recommended locations for Architectural Hardware for Flush Wood Doors [Note all referenced dates of standards must be updated to current for construction documents.](#)
- .6 Door and Hardware Institute (DHI) – Installation Guidelines for Doors and Hardware [Note all referenced dates of standards must be updated to current for construction documents.](#)
- .7 National Fire Protection Association (NFPA):
 - a. NFPA 80 - Standard for Fire Doors and Other Protective Openings [Note all referenced dates of standards must be updated to current for construction documents.](#)
 - b. NFPA 105 - Standard for Smoke Door Assemblies and Other Opening Protectives. [Note all referenced dates of standards must be updated to current for construction documents.](#)
 - c. NFPA 252- Standard Method of Fire Test for Door Assemblies. [Note all referenced dates of standards must be updated to current for construction documents.](#)
 - d. NFPA 257 - Standard on Fire Test for Window and Glass Block Assemblies. [Note all referenced dates of standards must be updated to current for construction documents.](#)
- .8 Warnock Hersey Intertek Testing Services (ITS-WH): ITS Certification Listings for Fire Doors.
- .9 Underwriters Laboratories Canada (ULC): CAN 4-S104 - Fire Tests of Door Assemblies. [Note all referenced dates of standards must be updated to current for construction documents.](#)
- .10 Window and Door Manufacturer's Association (WDMA): WDMA 1. S.1A-13. [Note all referenced dates of standards must be updated to current for construction documents.](#)

.4 Submittal

- .1 Comply with Submittal Procedures.
- .2 Evaluation Reports: For intumescent/wood fire-rated interior door and sidelight frames, WHI certification by Intertek.
- .3 Product Data: Manufacturer's data sheets on each type of door and jamb, including:
 - a. Preparation instructions and recommendations.
 - b. Storage and handling requirements and recommendations.
 - c. Installation methods.
- .4 Shop Drawings:
 - a. Elevations indicating location, size and kind of each door, construction, swing, label, undercut, and hardware location and machining requirements. Include location and extent of hardware blocking, fire ratings, requirement for factory finishing, glass and other pertinent data.
 - b. Elevations indicating veneer requirements. Include veneer grade, cut, species, piece match, face match, appearance of pairs, sets and transoms and aesthetic grade. For HPDL face requirement include manufacturer, thickness, pattern, color and finish.
- .5 Do not proceed with fabrication without receipt of approved submittal drawings and approved hardware schedules.
- .6 LEED Submittals:
 - a. Certificates for Credit MR 7: Chain-of-custody certificates certifying that flush wood doors comply with forest certification requirements.
 - b. Include evidence that manufacturer is certified for chain of custody by an FSC- accredited certification body.
 - a. Include statement indicating costs for each certified wood product.
 - c. Product Data for Credit EQ 4.1: For adhesives and composite wood products, documentation indicating that product contains no urea formaldehyde.
- .7 Other Action Submittals:

Door Hardware Schedule: Prepared by or under the supervision of a qualified Architectural Hardware Consultant (AHC) or Electrified Hardware Consultant (EHC), detailing fabrication and assembly of door hardware, as well as installation procedures and diagrams. Coordinate final door hardware schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware. [Door hardware schedule must be submitted for review and approval by CUFMP three \(3\) months prior to issuing for tender.](#)

.5 Quality Assurance

- .1 Non-Fire-Rated Doors: Provide doors that comply with NAAWS Section 9 and WDMA1.S. 1A.
- .2 Fire-Rated Doors: Provide doors that comply with NFPA 80, NFPA 252, CAN 4-S104 - Fire Tests of Door Assemblies, as applicable and as acceptable to authorities having jurisdiction, and that are listed and labeled by ITS-WH or a qualified testing agency. Notify Architect prior to fabrication if fire doors required cannot qualify for labeling due to design, size, hardware or another requirement.
- .3 LEED Requirement for FSC Certification:
Provide as required by architect and/or engineer.
- .4 Manufacturer Qualifications: A qualified manufacturer that is certified for chain of custody by an FSC- accredited certification body.
- .5 Single Source Responsibility: Provide doors from a single source to ensure uniformity in quality of appearance, face veneer, finish and construction.

.6 Delivery, Storage, and Handling

- .1 Store products in manufacturer's unopened packaging until ready for installation. Inspect for damage.
- .2 Storage and Protection: Comply with door manufacturer's written recommendations and requirements of AWI Section 1300 G-23 and WDMA standards.

.7 Project Conditions

- .1 Maintain environmental conditions including temperature, humidity, and ventilation within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits. Inspect for damage prior to installation.
- .2 Environmental Limitations: Do not deliver or install wood materials until building is enclosed and weatherproof, wet Work in space is completed and nominally dry, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during remainder of construction period.
- .3 Do not install wood materials that are wet, moisture damaged, or mold damaged.

- a. Indications that materials are wet or moisture damaged include discoloration, sagging, or irregular shape.
- b. Indications that materials are mold damaged include fuzzy or splotchy surface contamination and discoloration.

.8 Warranty

- .1 Provide manufacturer's standard warranty against defects in materials and workmanship for the following duration:
 - a. Warranty Period, Interior Doors: For the lifetime of the door.

Part 2 – Products

.1 Manufacturers

- .1 Acceptable Manufacturer: Baillargeon Doors Inc.
- .2 Acceptable Manufacturer: Lambton Doors
- .3 No Substitutions

.2 Wood Doors

- .1 Wood Doors: Height, width, configuration and location as scheduled on Drawings.
- .2 Light Cutouts: Minimum stile 6 inches (152mm); Minimum top rail 8 inches (203mm); Minimum middle rail 8 inches (203mm); Minimum bottom rail 12 inches (305mm).
- .3 Wood doors are not to be used in high-use fire-rated assemblies.
- .4 Wood Exterior Doors - not permitted.

.3 Architectural Flush Wood Interior Doors

- .1 Ultra-Heavy Duty Wood Interior Door:
 - a. Product: 8520-ME (5-ply - Particle Core) as manufactured by Baillargeon WoodDoor Manufacturer. Lifetime Warranty.
 - a. Fire Rating: 20-minutes, in compliance with NFPA 80.
 - b. Product: 5-8500-ME (5-ply - Particle Core) as manufactured by Lambton WoodDoor Manufacturer. Lifetime Warranty.
 - a. Fire Rating: 20-minutes, in compliance with NFPA 80.
 - c. Stiles: 1/8-inch (3 mm) thick veneer, longitudinally laminated by hot pressing with type 1 structural glue, as per ASTM-D5456-93 (LVL), including a 7/8-inch (22 mm) piece of hardwood, matched with faces, for a total width of 4-3/16 inches (107 mm).
 - d. Top and bottom rails: 1/8 inch (3 mm) thick veneer, longitudinally

laminated by hot pressing with type 1 structural glue, as per ASTM-D5456-93 (LVL), for a total width of 3-5/16 inches (85 mm).

- e. Stiles and Rails: Bonded to core.
- f. Lock and Hardware Blocking: Integrated. Required at all hardware preparations.
- g. Glue: Type1 PVA Cross-link.
- h. Faces: Refer to Door Characteristics.

.4 Flush Wood Interior Fire Doors

.1 Fire Rated Wood Door - Mineral Core:

- a. Product: 5045-M0 (5 ply - Mineral Core) as manufactured by Baillargeon WoodDoor Manufacturer. Lifetime Warranty.
 - i. Fire Rating: 45 minutes, in compliance with NFPA 80.
- b. Product: 5-FD45-ME (5 ply - Mineral Core) as manufactured by Lambton WoodDoor Manufacturer. Lifetime Warranty.
 - i. Fire Rating: 45 minutes, in compliance with NFPA 80.
- c. Product: 5060 (5 ply - Mineral Core) as manufactured by Baillargeon WoodDoor Manufacturer. Lifetime Warranty.
 - i. Fire Rating: 60 minutes, in compliance with NFPA 80.
- d. Product: 5-FD60-ME (5 ply - Mineral Core) as manufactured by Lambton WoodDoor Manufacturer. Lifetime Warranty.
 - i. Fire Rating: 60 minutes, in compliance with NFPA 80.
- e. Product: 5090 (5 ply - Mineral Core) as manufactured by Baillargeon WoodDoor Manufacturer. Lifetime Warranty.
 - i. Fire Rating: 90 minutes, in compliance with NFPA 80.
- f. Product: 5-FD90-ME (5 ply - Mineral Core) as manufactured by Lambton Wood Door Manufacturer. Lifetime Warranty.
 - i. Fire Rating: 90 minutes, in compliance with NFPA 80.
- g. Stiles: Special construction compliant with W/H label requirements. High-density mineral and untreated hardwood (minimum of 3/4 inch (19 mm)), bonded to core.
 - i. MO/ME: Manufacturer's choice/ Matching Edge.
- h. Top and Bottom Rails: Special construction compliant with W/H label requirements. Mineral or untreated hardwood, manufacturer's choice (minimum of 1-3/8 inches(35 mm)). Bonded to core.
 - i. Core: Non-combustible mineral.
- j. Fire Rated Lock and Hardware Blocking: Integrated. Required at all hardware preparations.
- k. Glue: Type 1 PVA.
- l. Faces: Refer to Door Characteristics.
- m. Pressure Provision: Neutral pressure in accordance with UL 10B/ UBC 7-2.
 - n. Pressure Provision: Positive pressure in accordance with UL 10C/ UBC 7-2, Category A: Firedoors that are not required the addition of the other components such as edge seals. Intumescent being incorporated in the door

- construction.
- o. Pressure Provision: Positive pressure in accordance with UL 10C/ UBC 7-2, Category B: Fire doors that required the addition of an edge seal. Edge seal may be intumescent and /or gasketing. Edge seals are typically added to the frame.
- .2 Fire Rated Wood Door – Agrifibre Core
 - a. Product: AF45-MO (5 ply - Agrifibre Core) as manufactured by Baillargeon WoodDoor Manufacturer. Lifetime Warranty.
 - i. Fire Rating: 45 minutes, in compliance with NFPA 80.
 - b. Product: 5-AG45-ME (5 ply - Agrifibre Core) as manufactured by Lambton WoodDoor Manufacturer. Lifetime Warranty.
 - i. Fire Rating: 45 minutes, in compliance with NFPA 80.

.5 Finishes

- .1 Finishes:
 - a. General: Complete fabrication, including fitting doors for openings and machining for hardware that is not surface applied, before finishing. Finish faces, all 4 edges if back is visible or 3 edges if back not visible, edges of cut-outs, and mortises. Stains and fillers may be omitted on bottom edges, edges of cutouts, and mortises.
 - b. Field Applied Finish: Refer to Section 09 91 00 Painting specifications.
 - i. Any site modifications to door must be sealed in accordance with manufacturer's instructions to prevent warpage.
 - c. Factory Finishing: All products in this section requiring factory finishing shall use Architectural Woodwork Standards 2nd Edition 2014, System 9 UV Curable System.
 - i. Factory Stain: Water-based stain with ultraviolet (UV) curable polyurethane.
 - ii. Factory Opaque Finish: Water-based paint with ultraviolet (UV) curable polyurethane.
 - iii. Factory seal top and bottom of doors.
 - iv. Provide touch-up Kit for field touch-ups.

Part 3 – Execution

.1 Examination

- a. Do not begin installation until adjacent construction has been properly prepared.
- b. If adjacent construction preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.
- c. Examine substrates, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance. If preparation is the responsibility of another installer, notify Architect in writing of deviations from manufacturer's recommended installation tolerances and conditions.

- d. Examine finish carpentry materials before installation. Reject materials that are wet, moisture damaged, and mold damaged.
- e. Do not proceed with installation until substrates and materials have been properly prepared and deviations from manufacturer's recommended tolerances are corrected. Prepare surfaces and materials using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.
- f. Proceed with installation only after unsatisfactory conditions have been corrected. Commencement of installation constitutes acceptance of conditions.

.2 Preparation

- .1 Prepare surfaces using the methods recommended by the manufacturer to achieve the best result for the substrate under the project conditions.
 - a. Before installing interior finish carpentry, condition materials to average prevailing humidity in installation areas for a minimum of 24 hours unless longer conditioning is recommended by the manufacturer.

.3 Wood Door Installation

- .1 Install wood doors in accordance with manufacturer's instructions.
- .2 Install wood door hardware in accordance with door and hardware manufacturer's instructions. Adjust hardware for proper door function and latching, and for smooth operation without excessive force or excessive clearance.
- .3 Install fire rated doors in corresponding fire rated frames in accordance with the requirements of the labeling agency and NFPA 80.

** Inspection of the installation may be completed by Carleton University or their representative at random times during the various phases of construction to ensure the doors are properly functioning and latching.*

.4 Cleaning and Protection

- .1 Clean exposed and semi exposed surfaces. Touch up finishes to restore damaged or soiled areas.
- .2 Protect installed products until completion of project.

- .3 Touch-up, repair, or replace damaged products before Substantial Completion.
 - a. Remove and replace frame material that is wet, moisture damaged, and mold damaged. Indications that materials are wet or moisture damaged include discoloration, sagging, or irregular shape. Indications that materials are mold damaged include fuzzy or splotchy surface contamination and discoloration.

Disclaimer Statement

This specification guideline is intended to be used by a qualified construction specifier. The guide specification is not intended to be verbatim as project specification without appropriate modifications for the specific use intended. The specification guideline must be used and coordinated with the procedures of each design firm, coordinate with Carleton Facilities Management and the requirements of a specific construction project.

End of Section

08 33 00 – Overhead Doors

The purpose of this design guideline is to establish fundamental requirements for the specification, manufacturer, and installation of overhead doors. The selection of overhead door sizes, door faces, and hardware for specific applications establish a variety of criteria that include fire and life safety codes, building codes, barrier free accessibility, security and electronic access control.

- .1 For overhead doors, specify vision panels of wired glass; weather-strip all edges and door sill bottoms.
- .2 Specify door assemblies that are available and serviced locally.
- .3 All overhead door hardware to be heavy duty, 16-gauge rails, heavy duty tension spring balances, door panels – 18-gauge, insulated with neoprene weather-stripping.

Disclaimer Statement

This specification guideline is intended to be used by a qualified construction specifier. The guide specification is not intended to be verbatim as project specification without appropriate modifications for the specific use intended. The specification guideline must be used and coordinated with the procedures of each design firm, coordinate with Carleton Facilities Management and the requirements of a specific construction project.

End of Section

08 41 13 – Aluminum Doors and Frames

The purpose of this design guideline is to establish fundamental requirements for the specification, manufacturer, and installation of aluminum doors and frames. The selection of aluminum doors and frames sizes, frame profiles, door faces, door lite configurations and hardware locations for specific applications establish a variety of criteria that include life safety codes, building codes, barrier free accessibility, security and electronic access control.

Part 1 – General

.1 Summary

This Section includes commercial aluminum entrances, including doors, glass, glazing, frames, transom frames, sidelight and window assemblies as shown in the contract documents.

For high traffic exterior and corrosive areas see Specialty Door Specification Section 08 17 43 for FRP Doors and Frames

.2 Products Provided Under This Section

- .1 KAWNEER 500 Swing Door, Wide stile, 5 inches (127mm), Top rail 5 inches (127mm), Mid rail 6 inches (152mm), Bottom rail 10 inches (254mm) 1.75 inches (45mm) Thickness, high traffic applications.
- .2 KAWNEER 560 Swing Door, Wide stile, 5.5625 inches (141mm) Top rail 5.5625 inches (141mm), Mid rail 6 inches (152mm), Bottom rail 10 inches (254mm), 2.25 inches (57mm) Thickness, High traffic applications.
- .3 SPECIAL-LITE SL-15 Monumental Swing door, Wide stile 4.75 inches (121mm), Top rail 6.5 inches (165mm), Mid rail 6-1/2 inches (165mm), Bottom rail 10 inches (254mm), 1.75 inches (57mm) Thickness, very high traffic applications.

.3 Submittals

List related sections to Aluminum Doors and Frames.

.4 References

- .1 ASTM B 209 – Aluminum and Aluminum Alloy Sheet and Plate. [Note all referenced dates of standards must be updated to current for construction documents.](#)
- .2 ASTM B 221 – Aluminum Alloy Extruded Bars, Rods, Wire Profiles and Tubes. [Note all referenced dates of standards must be updated to current for construction documents.](#)
- .3 ASTM D 6670-01 – Standard Practice for Full-Scale Chamber Determination of Volatile Organic Emissions from Indoor Materials/Products. [Note all referenced dates of standards must be updated to current for construction documents.](#)
- .4 ASTM E 84 – Surface Burning Characteristics of Building Materials. [Note all referenced](#)

dates of standards must be updated to current for construction documents.

- .5 ASTM E 283 – Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls and Doors Under Specific Pressure Differences Across the Specimen. *Note all referenced dates of standards must be updated to current for construction documents.*
- .6 ASTM E 330 – Structural Performance of Exterior Windows, Curtain Walls and Doors by Uniform Static Air Pressure Difference. *Note all referenced dates of standards must be updated to current for construction documents.*
- .7 ASTM E 331 – Test Method for Water Penetration of Exterior Windows, Curtain Walls and Doors by Uniform Static Air Pressure Difference. *Note all referenced dates of standards must be updated to current for construction documents.*
- .8 ASTM E 1886 – Standard Test Method for Performance of Exterior Windows, Curtain Walls, Doors and Storm Shutters Impacted by Missile(s) and Exposed to Cyclical Pressure Differentials. *Note all referenced dates of standards must be updated to current for construction documents.*

.5 Performance Requirements

Insert wind load design pressures in psf and include applicable building code and year edition as required by architect and/or engineer

.6 Submittals

- .1 Comply with Submittal Procedures.
- .2 Product Data: Submit manufacturer's product data, including description of materials, material thickness, components, fabrication, finishes, and installation instructions.
- .3 Shop Drawings: Submit door and frame schedule, door and frame shop drawings, including elevations, sections, and details, indicating dimensions, tolerances, materials, fabrication, doors, panels, framing, glazing, and finish.
- .4 Other Action Submittals:
 - a. Entrance Door Hardware Schedule: Prepared by or under the supervision of a qualified Architectural Hardware Consultant (AHC) or Electrified Hardware Consultant (EHC), detailing fabrication and assembly of door hardware, as well as installation procedures and diagrams. Coordinate final door hardware schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware. *Door hardware schedule must be submitted for review and approval by CUFMP three (3) months prior to issuing for tender*

.7 Quality Assurance

- .1 Manufacturer's Qualifications:
 - a. Continuously engaged in manufacturing of doors of similar type to that

specified, with a minimum of 25 years successful experience.

b. Door and frame components from same manufacturer.

.2 Installer Qualifications:

a. An installer which has had successful experience with installation of aluminum doors and frames with the same or similar units required for the project and other projects of similar size and scope.

b. Minimum 5 years experience with the installation of aluminum doors and frames.

.8 Delivery, Storage, and Handling

.1 Delivery: Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying opening door mark and manufacturer.

.2 Storage: Store materials in clean, dry area indoors in accordance with manufacturer's instructions.

.3 Handling: Protect materials and finish from damage during handling and installation.

.9 Warranty

.1 Warrant doors, frames, and factory hardware against failure in materials and workmanship, including excessive deflection, faulty operation, defects in hardware installation, and deterioration of finish or construction more than normal weathering.

.2 Warranty Period: Two (2) years from date of substantial completion of the project.

Part 2 – Products

.1 Acceptable Manufactures

.1 Kawneer Company Inc. – High Traffic Locations

.2 Special-Lite Inc. – Very High Traffic Locations

.3 No substitutions.

.2 Materials

.1 Aluminum Extrusions: Define manufacturers recommended alloy and material thickness for the main door and frame members.

.2 Fasteners: Define manufacturers recommended non-corrosive, nonmagnetic fasteners compatible with aluminum-framed entrance door members, trim hardware, anchors, and other components.

.3 Anchors, Clips, and Accessories: Define manufacturers recommended materials.

- .4 Reinforcing Members: Define manufacturers recommended materials.
- .5 Weather Seals: Define manufacturers recommended materials that comply with American Architectural Manufacturers Association (AAMA).

.3 Glazing

- .1 Glazing: As specified in Division 08 Section "Glazing".
- .2 Glazing Gaskets: Manufacturer's standard compression types; replaceable, extruded EPDM rubber.
- .3 Spacers and Setting Blocks: Manufacturer's standard elastomeric type.

.4 Hardware

- .1 Pre-machine doors in accordance with templates from 08 71 00 approved hardware schedule.
- .2 Weather-stripping to be supplied by manufacturer.
- .3 Surface mounted hardware such as rim exit device strikes, door closers and overhead stops/ holders to be installed with the appropriate shims and spacers to clear weather-stripping.

.5 Fabrication

- .1 Sizes and Profiles: Required sizes for door and frame units and profile requirements shall be as indicated on the Drawings.
- .2 Coordination of Fabrication: Field measure before fabrication and show recorded measurements on shop drawings.
- .3 Assembly:
 - a. Complete cutting, fitting, forming, drilling, and grinding of metal before assembly.
 - b. Remove burrs from cut edges.
- .4 Welding: Welding of doors or frames is not acceptable.
- .5 Fit:
 - a. Maintain continuity of line and accurate relation of planes and angles.
 - b. Secure attachments and support at mechanical joints with hairline fit at contacting members.

.6 Aluminum Finishes

- .1 Anodized Finish: Class I

finish, 0.7 mils thick. 1.

Clear 215 R1, AA-

M10C12C22A41

- a. Champagne, AA-M10C12C22A44
- b. Light Bronze, AA-M10C12C22A44
- c. Medium Bronze, AA-M10C12C22A44
- d. Dark Bronze, AA-M10C12C22A44
- e. Black, AA-M10C12C22A44

.2 Painted: Match existing colour and finish.

Part 3 – Execution

.1 Examination

- .1 Examine openings, substrates, structural support, anchorage, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.
Verify rough opening dimensions, levelness of sill plate and operational clearances. Examine wall flashings, vapor retarders, water and weather barriers, and other built-in components to ensure a coordinated installation.
 - a. Masonry Surfaces: Visibly dry and free of excess mortar, sand, and other construction debris.
 - b. Wood Frame Walls: Dry, clean, sound, well nailed, free of voids, and without offsets at joints. Ensure that nail heads are driven flush with surfaces in the opening and within 3 inches (76.2 mm) of opening.
 - c. Metal Surfaces: Dry; clean; free of grease, oil, dirt, rust, corrosion, and welding slag; without sharp edges or offsets at joints.
 - d. Proceed with installation only after unsatisfactory conditions have been corrected.
- .2 Coordinate examination with Carleton University prior to installation.

.2 Preparation

- .1 Ensure openings to receive frames are plumb, level, square, and in tolerance.

.3 Installation

- .1 Install doors in accordance with manufacturer's written instructions for installing aluminum-framed entrance doors, hardware, accessories and other components.
- .2 Install doors plumb, level, square, true to line, and without warp or rack.
- .3 Anchor frames securely in place.

- .4 Separate aluminum from other metal surfaces with bituminous coatings or other means approved by Architect.
- .5 Set thresholds in bed of grout or sealant as indicated and back seal, for weather tight construction.
- .6 Install exterior doors to be weather tight in closed position.
- .7 Repair minor damages to finish in accordance with manufacturer's instructions and as approved by Architect.
- .8 Remove and replace damaged components that cannot be successfully repaired as determined by Architect.
- .9 Coordinate inspection with Carleton University during and after installation.

.4 Field Quality Control

- .1 Manufacturer's Field Services: Manufacturer's representative shall provide technical assistance and guidance for installation of doors.

.5 Adjusting

- .1 Adjust doors, hinges, and locksets for smooth operation without binding.

.6 Cleaning

- .1 Clean doors promptly after installation in accordance with manufacturer's instructions.
- .2 Do not use harsh cleaning materials or methods that would damage finish.

.7 Adjusting, Cleaning, and Protection

- .1 Protect installed doors to ensure that, except for normal weathering, doors will be without damage or deterioration at time of substantial completion.
- .2 Clean aluminum surfaces immediately after installing aluminum-framed entrance doors. Avoid damaging protective coatings and finishes. Remove excess sealants, glazing materials, dirt, and other substances.
- .3 Clean glass immediately after installation. Comply with glass manufacturer's written recommendations for final cleaning and maintenance. Remove nonpermanent labels, and clean surfaces.
- .4 Remove and replace glass that has been broken, chipped, cracked, abraded, or damaged during the construction period.

Disclaimer Statement

This specification guideline is intended to be used by a qualified construction specifier. The guide specification is not intended to be verbatim as project specification without appropriate modifications for the specific use intended. The specification guideline must be used and coordinated with the procedures of each design firm, coordinate with Carleton Facilities Management and the requirements of a specific construction project.

End of Section

08 42 29 – Aluminum Sliding Doors

The purpose of this design guideline is to establish fundamental requirements for the specification, manufacturer, and installation of automatic aluminum sliding doors. The selection of aluminum automatic sliding doors and frames sizes, frame profiles, door faces, door lite configurations and hardware locations for specific applications establish a variety of criteria that include life safety codes, building codes, barrier free accessibility, security and electronic access control.

1. *Use of aluminum sliding automatic doors is permitted under the following conditions and with prior approval of each location by Facilities Management and Planning.*
2. *Sliding doors will be Horton Automatics 2000 series and must comply with the following properties:*
 - *Breakaway doors*
 - *6 mil tempered safety glass*
 - *Surface mounted header switch is not permitted, rather an On/Off hold open key switch with LED indicators (Green=operational, Red=disarmed) Will accept Medeco mortise cylinder 10W0200- 26-Z01. Key switch to be mounted on secure side of door.*
 - *Cylinder and key switch mounted 1200mm from finished floor. Key switch to have security head torx type screws*
 - *Thresholds only on exterior doors*
 - *Adams Rite hook latch-mortise*
 - *Medeco cylinder to suit by CUFMP*
 - *Approved electronic locking device*

Part 1 - General

.1 Summary

This Section includes Automatic Aluminum Sliding Doors, including Operators and Control devices, as shown in the contract documents.

.2 Products Provided Under this Section

- .1 Automatic Aluminum Sliding Door Systems.

.3 Related Sections

List related sections to Aluminum Doors and Frames.

.4 References

List publications referenced with the most recent Standard that is available, the Specifier must verify its applicability to the Specification prior to its inclusion.

- .1 ANSI A156.5 - Standard for Auxiliary Locks and Associated Products
- .2 ANSI A156.10 - Power Operated Pedestrian Doors.
- .3 ANSI-Z97.1.2 - Safety Performance Specifications and Methods of Test for Safety Glazing Materials Used in Buildings.
- .4 ASTM A 36 / A36 M - Standard Specification for Carbon Structural Steel.
- .5 ASTM A 924 / A 924M - Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.
- .6 ASTM B 209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
- .7 ASTM B 221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
- .8 ASTM E 283 - Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.
- .9 ASTM E 330 - Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference.
- .10 ASTM F 842 - Standard Test Methods for Measuring the Forced Entry Resistance of Sliding Door Assemblies, Excluding Glazing Impact.
- .11 Aluminum Association Standard AA - Aluminum Finishes.
- .12 PA 201-94 - Large and Small Missile Impact Test. Dade County Code Compliance Protocols.
- .13 PA 202-94 - Uniform Static Pressure Test. Dade County Code Compliance Protocols.
- .14 PA 203-94 - Cyclic Wind Pressure Loading Test. Dade County Code Compliance Protocols.
- .15 NFPA 70 - National Electric Code.
- .16 NFPA 101 - Life Safety Code.
- .17 UL325 - Door, Drapery, Gate, Louver, and Window Operators and Systems - (UL) listed.
- .18 Intertek, Warnock Hersey (ETL) - Testing Laboratory and Certification Agency joined with ETL Semko.
- .19 UFC 4-010-01 - DOD Minimum Antiterrorism Standards for Buildings

.5 Performance Requirements

Wind load design pressures shall be determined by design architect and/or engineer and shall be in psf and include applicable building code and year edition.

.6 Submittals

- .1 Comply with Submittal Procedures.
- .2 Product Data: Submit manufacturer's product data, including description of materials, material thickness, components, fabrication, finishes, and installation instructions.
- .3 Shop Drawings: Submit door and frame schedule, door and frame shop drawings, including elevations, sections, and details, indicating dimensions, tolerances, materials, fabrication, doors, panels, framing, glazing, and finish.
- .4 Other Action Submittals:
 - a. Entrance Door Hardware Schedule: Prepared by or under the supervision of a qualified Architectural Hardware Consultant (AHC) or Electrified Hardware Consultant (EHC), detailing fabrication and assembly of door hardware, as well as installation procedures and diagrams. Coordinate final door hardware schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.

.7 Quality Assurance

- .1 Manufacturer's Qualifications:
 - a. Continuously engaged in manufacturing of doors of similar type to that specified, with a minimum of 25 years successful experience.
 - b. Door and frame components from same manufacturer.
- .2 Installer Qualifications:
 - a. An installer which has had successful experience with installation of aluminum doors and frames with the same or similar units required for the project and other projects of similar size and scope.
 - b. Minimum 5 years experience with the installation of aluminum doors and frames.
 - c. Certified Inspector: Copy of current AAADM Certification for AAADM inspector prior inspection.

.8 Delivery, Storage, and Handling

- .1 Delivery: Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying opening door mark and manufacturer.
- .2 Storage: Store materials in clean, dry area indoors in accordance with manufacturer's instructions.
- .3 Handling: Protect materials and finish from damage during handling and installation.

.9 Warranty

- .1 Warrant doors, frames, and factory hardware against failure in materials and workmanship, including excessive deflection, faulty operation, defects

in hardware installation, and deterioration of finish or construction more than normal weathering.

- .2 Warranty Period: Two (2) years from date of substantial completion of the project.

Part 2 – Products

.1 Acceptable Manufactures

- .1 Horton Automatics Sliding Door System with Electric Belt Drive Operator: Horton Automatics Profiler Series 2000 with operator, header with roller track, carrier assemblies, framing, sliding door panel(s), sidelight(s), activation, safety devices and accessories required for complete installation.
- .2 No substitutions.

.2 Materials

- .1 Aluminum Extrusions: Define manufacturers recommended alloy and material thickness for the main door and frame members.
- .2 Fasteners: Define manufacturers recommended non-corrosive, nonmagnetic fasteners compatible with aluminum-framed entrance door members, trim hardware, anchors, and other components.
- .3 Anchors, Clips, and Accessories: Define manufacturers recommended materials.
- .4 Reinforcing Members: Define manufacturers recommended materials.
- .5 Weather Seals: Define manufacturers recommended materials that comply with American Architectural Manufacturers Association (AAMA).

.3 Glazing

- .1 Glazing: As specified in Division 08 Section “Glazing”.
- .2 Glazing Gaskets: Manufacturer's standard compression types; replaceable, extruded EPDM rubber.
- .3 Spacers and Setting Blocks: Manufacturer's standard elastomeric type

.4 Hardware

- .1 Pre-machine doors in accordance with templates from 08 71 00 approved hardware schedule.
- .2 Weather-stripping to be supplied by manufacturer.

.5 Fabrication

- .1 Sizes and Profiles: Required sizes for door and frame units and profile requirements shall be as indicated on the Drawings.
- .2 Coordination of Fabrication: Field measure before fabrication and show recorded measurements on shop drawings.
- .3 Assembly:
 - a. Complete cutting, fitting, forming, drilling, and grinding of metal before assembly.
 - b. Remove burrs from cut edges.
- .4 Welding: Welding of doors or frames is not acceptable.
- .5 Fit:
 - a. Maintain continuity of line and accurate relation of planes and angles.
 - b. Secure attachments and support at mechanical joints with hairline fit at contacting members.

.6 Aluminum Finishes

- .1 Anodized Finish: Class I finish, 0.7 mills thick.
 - a. Clear 215 R1, AA-M10C12C22A41
 - b. Champagne, AA-M10C12C22A44
 - c. Light Bronze, AA-M10C12C22A44
 - d. Medium Bronze, AA-M10C12C22A44
 - e. Dark Bronze, AA-M10C12C22A44
 - f. Black, AA-M10C12C22A44
- .2 Painted: Match existing colour and finish.

Part 3 – Execution

.1 Examination

1. Examine openings, substrates, structural support, anchorage, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work. Verify rough opening dimensions, levelness of sill plate and operational clearances. Examine wall flashings, vapor retarders, water and weather barriers, and other built-in components to ensure a coordinated installation.
 - a. Masonry Surfaces: Visibly dry and free of excess mortar, sand, and other construction debris.
 - b. Wood Frame Walls: Dry, clean, sound, well nailed, free of voids, and without offsets at joints. Ensure that nail heads are driven flush with surfaces in opening and within 3 inches (76.2 mm) of opening.

- c. Metal Surfaces: Dry; clean; free of grease, oil, dirt, rust, corrosion, and welding slag; without sharp edges or offsets at joints.
 - d. Proceed with installation only after unsatisfactory conditions have been corrected.
2. Coordinate examination with Carleton University prior to installation.

.2 Preparation

1. Ensure openings to receive frames are plumb, level, square, and in tolerance.

.3 Installation

1. Install doors in accordance with manufacturer's written instructions for installing aluminum-framed entrance doors, hardware, accessories and other components.
2. Install doors plumb, level, square, true to line, and without warp or rack.
3. Anchor frames securely in place.
4. Separate aluminum from other metal surfaces with bituminous coatings or other means approved by Architect.
5. Set thresholds in bed of grout or sealant as indicated and back seal, for weather tight construction.
6. Install exterior doors to be weather tight in closed position.
7. Repair minor damages to finish in accordance with manufacturer's instructions and as approved by Architect.
8. Remove and replace damaged components that cannot be successfully repaired as determined by Architect.
9. Coordinate inspection with Carleton University during and after installation.

.4 Field Quality Control

1. Manufacturer's Field Services: Manufacturer's representative shall provide technical assistance and guidance for installation of doors.

.5 Adjusting

1. Adjust doors, sliding tracks, hangers and locksets for smooth operation without binding.

.6 Cleaning

1. Clean doors promptly after installation in accordance with manufacturer's instructions.
2. Do not use harsh cleaning materials or methods that would damage finish.

.7 Adjusting, Cleaning, and Protection

1. Protect installed doors to ensure that, except for normal weathering, doors will be without damage or deterioration at time of substantial completion.
2. Clean aluminum surfaces immediately after installing aluminum-framed entrance doors. Avoid damaging protective coatings and finishes. Remove excess sealants, glazing materials, dirt, and other substances.
3. Clean glass immediately after installation. Comply with glass manufacturer's written recommendations for final cleaning and maintenance. Remove nonpermanent labels, and clean surfaces.
4. Remove and replace glass that has been broken, chipped, cracked, abraded, or damaged during construction period.

Disclaimer Statement

This specification guideline is intended to be used by a qualified construction specifier. The guide specification is not intended to be verbatim as project specification without appropriate modifications for the specific use intended. The specification guideline must be used and coordinated with the procedures of each design firm, coordinate with Carleton Facilities Management and the requirements of a specific construction project.

End of Section

08 71 00 – Hardware Specification

The purpose of this design guideline is to establish fundamental requirements for the specification, manufacturer, supply and installation of architectural hardware. The selection of architectural hardware and locations for specific applications establish a variety of criteria that include fire and life safety codes, building codes, barrier free accessibility, security and electronic access control.

Part 1 – General

.1 Summary

- .1 Section includes:
 - a. Hardware for swinging Aluminum, Hollow Metal and Wood Door openings.
 - b. Low Energy Automatic Operators

.2 References

- .1 Use the following references to detail, schedule, furnish and install finish hardware items.
 - a. National Fire Protection Association (NFPA 80) – Standard for Fire Doors and Other Opening Protectives [Note all referenced dates of standards must be updated to current for construction documents.](#)
 - b. Door and Hardware Institute (DHI) – Installation Guide for Doors and Hardware [Note all referenced dates of standards must be updated to current for construction documents.](#)
 - c. DHI – Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames [Note all referenced dates of standards must be updated to current for construction documents.](#)
 - d. DHI – Sequence and Format for the Hardware Schedule [Note all referenced dates of standards must be updated to current for construction documents.](#)
 - e. DHI – Keying Systems and Nomenclature [Note all referenced dates of standards must be updated to current for construction documents.](#)
 - f. American National Standards Institute/Builders Hardware Manufacturers Association (ANSI/BHMA) A156.4 – Door Controls – Closers [Note all referenced dates of standards must be updated to current for construction documents.](#)
 - g. ANSI/BHMA A156.13 – Mortise Locks and Latch Series 1000 [Note all referenced dates of standards must be updated to current for construction documents.](#)
 - h. ANSI/BHMA A156.18 – Materials and Finishes [Note all referenced dates of standards must be updated to current for construction documents.](#)

.3 Submittals

.1 General Requirements:

- a. Furnish submittals in accordance with 01 33 00 – Submittal Procedures.

.2 Schedules:

- a. Furnish hardware schedule electronically in .pdf format, vertical format, formatted for 8-1/2-inch (216mm) by 11-inch (292mm) paper. Conform to DHI publications "Sequence and Format for the Hardware Schedule". Use architect's door numbers and hardware set numbers. Group identical openings in hardware headings. **Door hardware schedule must be submitted for review and approval by CUFMP three (3) months prior to issuing for tender**
- b. Furnish elevation drawings for openings with electrical hardware and access control devices with each hardware schedule. Include elevation of opening, operation description, electrified hardware components, legend, approximate mounting location, size of enclosures, size and quantities of conductors, facility name and date. Include operational description for confirmation by Carleton University Facilities Management and Planning (CUFMP).
- c. Prior to submission stamp the hardware schedule with the seal from an Architectural Hardware Consultant (AHC) or an Electrified Hardware Consultant (EHC) who is enrolled in the DHI Continuing Education Program to ensure correctness and compliance with specification requirements.

.3 Product Data:

- a. Furnish manufactures catalogue and technical data electronically in .pdf format for each hardware item used. Highlight design, function, accessories, options and fasteners to facilitate review with each hardware schedule submitted.

.4 Templates:

- a. Furnish manufacturers hardware templates electronically in .pdf format upon receipt of approved hardware schedule to the door and frame supplier(s) upon request. Include location of internal reinforcements for surface mounted hardware.

.5 Wiring Diagrams:

- a. Submit wiring diagrams electronically in .pdf format after receipt of approved hardware schedule. Include project name, date and contact information.
- b. Create drawings for each opening that requires electrical hardware.
- c. Using architects opening number, generate point-to point drawings referencing elevation drawings submitted with hardware schedule. Include lines representing terminations, colour of conductors, labels for each component and terminal, and an operational description of the system function.
- d. Furnish system diagrams for openings requiring access control and shared

power supplies, distance of wires run from power supply, cable quantity, number and gauges of wire.

.6 Keying Schedule:

- a. Keying schedule to be prepared by CUFMP.

.7 Samples:

- a. Submit one wall stop sample with the hardware submittal, labeled with hardware set and door number to show compliance with the specification. Return sample to supplier. Approved samples are permitted to be used on the project.

.8 Operation and Maintenance Manuals:

- a. Furnish operation and maintenance manual in accordance with section 01 78 00 – Closeout Submittals as follows:
 - a. Furnish an electronic copy of the manual in .pdf format at date of substantial completion with project information, date, name and contact information of the hardware supplier.
 - b. Include in the manual:
 - 1) Copy of approved “As-Built” hardware schedule, including door numbers and locations. Highlight fire rated doors to aid in annual fire door inspection.
 - 2) Catalogue data for each product.
 - 3) “As-Installed” wiring diagrams for each opening connected to power.
 - 4) Parts list for locksets, exit devices, door closers, and automatic operators.
 - 5) Installation templates and instructions.
 - 6) Warranty information.

.4 Quality Assurance

.1 Supplier:

- a. Furnish hardware from a supplier who has actively supplied hardware for similar projects for a minimum of five years.
- b. Supplier must employ an AHC or EHC as certified by DHI, on staff full time to administer and supervise project

.2 Installer:

- a. Install hardware using installers who have a minimum of five years’ experience actively installing commercial door hardware for similar projects.

.3 Fire Rated Door Openings:

- a. Hardware installed on fire rated door assemblies shall comply with NFPA80 as tested and listed by door, frame and hardware manufactures.
 - b. Latch bolt assemblies, door closing devices and fire exit hardware shall bear labels or marks from testing as proof of compliance with fire rated door assemblies.
 - c. Provide fire exit hardware on doors bearing a label stating "Fire Door to be Equipped with Fire Exit Hardware".
- .4 Pre-Installation Meeting:
- a. Prior to installation of hardware, meet with installer, Carleton University project manager, Carleton University hardware representative and hardware supplier to review door, frame and hardware requirements for the project. Provide installer with a copy of the approved finish hardware schedule. Review manufactures installation instruction for each hardware item.
 - b. Inspect and discuss preparatory work performed by other trades.
 - c. Inspect and discuss electrical roughing-in for electrified door hardware.
 - d. Review sequence of operation for each type of electrified door hardware.
 - e. Review required testing, inspecting, and certifying procedures.
 - f. Review voltage requirements with electrical contractor to ensure all project requirements are met.

.5 Delivery, Storage, and Handling

- .1 Marking and Packaging:
- a. Deliver hardware to job site in one shipment, in manufacturers original packaging marked to correspond with the Architect's door numbers and the approved hardware schedule hardware sets.
 - b. Replace damaged or wed packaging with new.
- .2 Job Site Delivery:
- a. Jointly receive hardware upon delivery to job site against the approved hardware schedule with hardware supplier. Record missing or damaged hardware. Replace or repair as necessary.
 - b. Deliver hardware for doors and frames to manufacturer that is being installed during fabrication.
- .3 Storage:
- a. Store door hardware items in a temperature controlled secured room or space to protect from damage or loss.

- b. Store door hardware off the floor on shelving.
- c. Store large items of hardware (e.g. exit devices, door operators thresholds and gasketing) on wooden pallets. Arrange locksets and keyed cylinders by Architect's door opening number.
- d. Arrange remaining items by hardware set number.

.6 Warranty

- .1 Hardware items shall be guaranteed to be free from defects in materials and workmanship for the minimum period required by Section 01 78 36 – Warranties, in addition, the following hardware items shall have extended manufacturers warranties:
 - a. Hinges – Lifetime
 - b. Mechanical Mortise Locks – 10 Years
 - c. Electrified Strikes – 5 Years
 - d. Exit Devices – 2 Years
 - e. Door Closers – 30 Years
 - f. Automatic Door Operators – 2 Years

.7 Maintenance Service

- .1 Service Contracts:
 - a. Furnish service and maintenance for automatic operators for one year from date of substantial completion.
- .2 Extra Materials:
 - a. Upon date of substantial completion, any materials and/or products used that are not part of Carleton University Facilities Design Guideline, furnish extra tools and fasteners.

Part 2 – Products

.1 Acceptable Manufactures

The following are acceptable manufacturers for use on Carleton University projects. Like items shall be the product of one manufacturer.

- | | | |
|------------------------------------|----------------------------------|---|
| Hinges | Stanley, Hager | |
| Locksets | Corbin-Russwin, No substitutions | |
| Cylinders | | Medeco, No substitutions |
| Auxiliary Locks | | Corbin-Russwin, Adams Rite,
No substitutions |
| • Exit Devices, Removable Mullions | | Von Duprin, No substitutions |

Door Closers	LCN, No substitutions
Flush Bolts, Surface Bolts	Ives, Standard Metal
Overhead Stops	Glynn-Johnson, No substitutions
Automatic Operators	LCN, Entrematic, No
substitutions	
• Actuators	Camden, No substitutions
• Door Pulls, Push and Protection Plates, Astragals (CBH),	Canadian Builders Hardware
	Gallery, Standard Metal
• Floor Stops, Wall Stops	CBH, Standard Metal
• Coordinators	Ives, No substitutions
• Door Bottoms, Gasketing, Thresholds	KN Crowder, Pemko, Jacobs & Johnson, No Substitutions
• Electric Strike	HES, Von Duprin, No
substitutions	
• Magnetic Hold Open	LCN, No substitutions
• Door Position Switch	Honeywell, Sentrol, Schlage
• Power Transfers	Von Duprin, Securitron
• Power Supplies	Supplied by Division 26
• Card Readers	Supplied by Carleton University
• Key Switches, Relays, Annunciators	Camden, No substitutions
• Occupancy Sensors	BEA, No substitutions
• Piezo Sounders	Secutiron, No substitutions

.2 Materials

.1 Screws and Fasteners

- a. Provide manufacturer's recommended fasteners for each application, and door and frame material. Provide threaded nuts and bolts or through bolts and grommets for surface overhead stops and door closers. Provide thread-to-the-head wood screws for mortise hinges on wood doors. Provide sheet metal screws for screw applied weather strip and protection plates, except at lead lined doors where protection plates will be applied with adhesive. Provide stainless steel machine screws with lead anchors for thresholds. Provide machine screws with metal expansion shields where hardware is installed on concrete, masonry or tile. All fasteners to drilled and tapped into materials, self-tapping screws or tek screws are not acceptable even if supplied by manufacturer. Fasteners shall have Phillips type or Torx type security head drives as scheduled. Match exposed fasteners to hardware finish.

.2 Conventional Hinges

- a. Provide five knuckle, ball bearing, full mortise hinges. Provide non-removal pins (NRP) for all exterior doors and all interior out swinging doors with locking hardware. Size hinge height and weight in accordance with manufacturers recommendations. Provide two hinges per leaf for doors up to 1520mm (60 inches). Provide three hinges per leaf for doors up to 90 inches (2285mm) in height. Provide one additional hinge for each additional 30 inches (762mm) of door height or fraction thereof. Doors 1-3/4 inch (45mm) in thickness and up to 36 inches (914mm) in width, provide 4-1/2 inch (114mm) high hinges. Doors 1-3/4 inch (45mm) in thickness and over 36 inches (914mm) to 48 inches (1220mm), provide 5 inch (127mm) high hinges. Provide standard weight two ball bearing hinges on low traffic doors 36 inches (914mm) in cycle twenty-five times per day and under. Provide heavy weight four ball bearing hinge on high traffic doors 36 inches (914mm) and over in width and cycle twenty-five times or more. For doors in areas of high humidity provide hinges with non-corrosive, rust resistant brass base metal material with stainless steel pins. Provide stainless steel hinges for all fire rated doors.
- b. Provide the following:
 - i. Standard Weight – Stanley FBB179, FBB191
 - ii. Heavy Weight – Stanley FBB168, FBB199
 - iii. Standard Weight – Hager FBB1191, FBB1279
 - iv. Heavy Weight – Hager FBB1168, FBB1199

.3 Door Bolts

- a. Provide non-handed flush bolts, 13mm (1/2 inch) bolt diameter, 19mm (3/4 inch) projection, rod dimension as scheduled. Furnish top and bottom strikes.
 - i. Provide the following:
 - Flush Bolt – Ives FB458
 - Flush Bolt – Standard Metal F65UL
- *Use of manual flush bolts to be approved by authority having jurisdiction (AHJ) at fire rated openings.*
- *Use of dust proof strikes is not permitted.*
 - b. Provide non-handed automatic and constant latching flush bolts as scheduled, 1/2 inch (13mm) bolt diameter, 3/4 inch (19mm) projection, rod dimension as scheduled. Furnish top and bottom strikes.
 - Provide the following:
 - Automatic Flush Bolt – Ives FB31
 - Constant Latching Flush Bolt – Ives FB51
 - Automatic Flush Bolt – Standard Metal F71
 - Constant Latching Flush Bolt – F73
- *Use of automatic flush bolts shall only be specified with approval from CUFMP.*
- *Use of dust proof strikes is not permitted.*

- c. Provide non-handed surface bolts, heavy duty, fully concealed mounting, bolt body 8 inches 203mm x 7/8 inch 22mm x 3/4 inch (19mm), 1 inch (51mm) throw, locking option as scheduled. Locking bolts are furnished with 2 keys. Furnish universal top strike and flat bottom strike.
 - i. Provide the following:
 - o Surface Bolt – Ives SB1630TB
 - o Locking Surface Bolts – Ives SB1630TBL
 - o Surface Bolt – Standard Metal F67
 - o Or approved equivalent

.4 Locks and Latches

- a. Mortise Locks and Latches:
 - i. Mortise locks and latches to be heavy duty, Grade 1, centered in door, 2-3/4 inch (70mm) backset and handed for each opening. Furnish latch bolts with 3/4 inch (19mm) throw, wrought lever with rose trim design LWA (no substitutions). Functions as scheduled in hardware sets.
 - Passage – Corbin-Russwin ML2010
 - Privacy – Corbin-Russwin ML2068
 - Office – Corbin-Russwin ML2051
 - Classroom – Corbin-Russwin ML2055
 - Storeroom – Corbin-Russwin ML2057
 - Privacy – Corbin-Russwin ML2030
 - b. Auxiliary Locks: Minimum 25mm (1") bolt throw.
 - ii. Mortise Deadlocks shall be heavy duty, Grade 1, centered in door, 2-3/4" (70mm) backset and handed for each opening. Furnish with thumb turn.
 - Provide the following:
 - o Deadlock – Corbin-Russwin ML2017 Classroom Function
 - iii. Mortise deadlocks shall be heavy duty, Grade 1, centered in door, 1 inch (25mm) back set and handed for each opening. Furnish thumb turn and face plate appropriate to door edge.
 - Provide the following:
 - o Deadlock – Adams Rite MS1850SN MS Schoolhouse Function
 - iv. Padlocks shall be supplied with keys by CUFMP and the responsibility of the Contractor. To be returned within two (2) weeks as requested. For any padlocks and keys not returned within the allotted time, a minimum charge of \$1000.00 per padlock/key plus all costs associated with any other re-keying of buildings/areas will be levied against the project at the contractor's expense.
 - c. Cylinders:
- I. CUFMP shall supply mortise cylinders for locksets, auxiliary locks, key switches,

cylinder dogged exit devices, rim cylinders for exit devices, keyed removable mullions with appropriate cams, spacers, blocking rings, tailpieces and collars.

- Provide the following:
 - Medeco
 - II. Permanent cylinders to be supplied by CUFMP.
 - III. Interchangeable core cylinders to be supplied by CUFMP, installed by Contractor. Permanent interchangeable cores installed by CUFMP.
 - IV. Construction cylinders to be supplied with keys by CUFMP and the responsibility of the Contractor. Must be returned within two (2) weeks as requested by CUFMP.
 - V. When Cylinders and Keys are handed over, they responsibility of the Contractor and a minimum charge of \$1000.00 per key and/or cylinder plus all costs associated with any other re-keying of buildings/areas will be levied against the project at the contractor's expense for any keys and/or cylinders not returned within two (2) weeks of request from CUFMP for their return.
- d. Strikes:
- I. Provide 4-7/8 inch (124mm) high strikes with curved lip, sized to minimally clear trim for locks. Include dust box for each strike in single openings. Provide flat lip strike 7/8 inch (22mm) to center dimension at paired openings with overlapping flat astragals.

.5 Exit Devices

- a. General:
 - I. Provide heavy duty, grade 1 exit devices, sizes as per manufacturers recommendation. Rim exit devices required at singles openings and paired openings with keyed removable mullions, surface vertical rod (SVR) required at all paired openings, less bottom rod (LBR), push pad design, backset to accommodate soffit applied gasketing. Furnish with exterior lever trim.
 - II. Use of XP function and RX function is not permitted.
 - III. Double egress doors shall have keyed removable center mullions with rim exit devices.
 - IV. SVR exit devices with LBR are permitted where center or removable mullion is not possible.
 - V. Concealed vertical rod (CVR) exit devices are not permitted.
- b. Panic Hardware:
 - I. Provide UL/cUL listed panic exit devices furnished with cylinder dogging, delayed egress and alarm as scheduled.
 - Provide the following:
 - Exit Device – Von Duprin 98 Series

- c. Fire Exit Hardware:
 - II. Provide UL/cUL listed fire exit hardware at all fire rated openings. Furnish with delayed egress and alarm as scheduled.
 - Provide the following:
 - Exit Device – Von Duprin 98F Series
- d. Outside Trim:
 - III. Provide outside trim for exit devices with 03 lever design. Functions as scheduled in hardware sets.
 - Provide the following:
 - Outside Trim – Von Duprin 996Lx03
- e. Strikes:
 - IV. Provide strikes as per manufacturers recommendations for rim exit devices and concealed vertical rod exit devices. Furnish non-fire rated and fire rated models as scheduled in hardware sets.
 - Provide the following:
 - Rim Exit Device Strike – Von Duprin 299F
 - SVR Exit Device Strikes – Von Duprin 499F
- f. Keyed Removable Mullions:
 - V. Provide keyed removable mullions, Grade 1, UL/cUL for fire rated applications up to 3 hours, prepared for strike supplied with exit device, option for use of 1-1/4 inch (32mm) Medeco mortise cylinder. Shall be used in applications where aluminum or hollow metal double doors are installed. Mullion base plates to be installed with manufactures supplied anchoring only.
 - Provide the following:
 - Keyed Removable Mullion – Von Duprin KR9954 – For fire rated applications.
 - Keyed Removable Mullion – Von Duprin KR4954 – For non-fire rated applications.

.6 Surface Closers

- a. Provide extra heavy-duty hydraulic type surface door closers with adjustable backcheck, sweep and latch speeds. Closers to be sized in accordance with manufacturers recommendations. Furnish with heavy duty (EDA) arms, special mounting brackets, arms and templates for overhead stops and swing clear hinges. Closer arms, tracks and brackets to be mounted on the room side, away from corridor view. Push side mounting on out swinging exterior out swinging doors, stairwells, cross corridor doors.
 - Provide the following:
 - Regular Arm Closers – LCN 4040XP

- Top Jamb Arm Closers – LCN 4040XP
- Parallel Arm Closers – LCN 4040XP-EDA

- *Use of Concealed Closers is not permitted.*
- *Use of Delayed Action Closers is not permitted.*
- *Extra Duty (EDA) closer arms to be used in high traffic areas.*

.7 Automatic Operators

- a. Provide non-handed electromechanical low energy automatic operators with manufacturers arms and brackets for installation on room side, away from corridor view. Furnish with electronic control, adjustable opening, back check, closing speed, time delay, built-in adjustable stop and hold open switch. Furnish interface relay for electric strike, electric latch retraction (EL) and fire alarm where required. Furnish special mounting plates, brackets, arms and templates for use with overhead stops. Capable of maximum degree of openings 90 degrees. Furnish ON/OFF switch and hold open switch concealed within header housing.
 - Provide the following:
 - Automatic Operator – LCN 9530 or 9540 – *For use in high frequency areas.*
 - Automatic Operator – Entrematic – Ditec HA8-SP – *For use in low frequency areas.*

.8 Actuators

- b. Provide round push plate switch actuators, 6-inch diameter, stainless steel, vandal resistant, weather resistant, barrier free compliant with universal blue inset wheel chair symbol. Actuators shall be mounted in single gang electrical boxes with concealed tamper proof fasteners, hardware wired and rated to a minimum 15amp @ 30VAC.
 - Provide the following:
 - Actuator – Camden 60/2 – *For use in low traffic areas.*
 - Actuator – Camden CM7536/4 – *For use in high traffic areas.*

.9 Door Trim

- c. Door Pulls:

Provide door pulls fabricated from 1 inch (25mm) diameter stainless steel bar, 'D' shape, prepared for security through bolt and grommet mounting. To be mounted on 3-1/2 inch (89mm) x 15 inch (381mm) back plate fabricated from 0.050 inch (1.3mm) thick stainless steel with beveled edges all four sides. Without push bar combination mounting prepare for security bolt with button head, through bolt mounting.

 - Provide the following:
 - Door Pull – CBH 7423 x 1 inch (51mm), 6030
 - Door Pull – Gallery 1180-2, 166
 - Door Pull – Standard Metal 3012-2, D347

Push bars

Provide push bars fabricated from 1 inch (25mm) diameter stainless steel bar, extend horizontally across push side of doors, centered on the door stiles. With door pull combination furnish back to back common end mounting with security bolt with button head, through bolt mounting.

- Provide the following:
 - Push Bar – CBH 7040 x 51mm (1 inch)
 - Push Bar – Gallery 5000-2
 - Push Bar – Standard Metal 6000-2

.10 Protection Plates

- a. Provide protection plates with beveled edges all four sides, stainless steel 0.050-inch (1.27mm) thickness, and comply with fire door requirements. Dimension plates on push side of door 1-1/2 inch (38mm) less door width, 1 inch (25mm) on pairs of doors. Dimension plates on pull side of door 1 inch (25mm) less door width for single and pairs of doors. Dimension kick plates to fit bottom rail sizes, frame stop heights, astragal overlap, double egress doors, radius edges, and perimeter gasketing.
 - i. Armour Plates:
 - Armour Plates 32 inches (813mm) high – CBH 903
 - Armour Plates 32 inches (813mm) high – Gallery 80A
 - Armour Plates 32 inches (813mm) high – Standard Metal K10A
 - ii. Kick Plates:
 - Kick Plates 16 inches (406mm) high or Fit to Bottom Rail – CBH 903
 - Kick Plates 16 inches (406mm) high or Fit to Bottom Rail – Gallery 80A
 - Kick Plates 16 inches (406mm) high or Fit to Bottom Rail – Standard Metal K10A
 - iii. Mop Plates:
 - Mop Plate 6 inches (152mm) high – CBH 903
 - Mop Plate 6 inches (152mm) high – Gallery 80A
 - Mop Plate 6 inches (152mm) high – Standard Metal K10A
 - iv. Push Plates:
 - Push Plates Width X Height as scheduled – CBH 923
 - Push Plates Width X Height as scheduled – Gallery 81A
 - Push Plates Width X Height as scheduled – Standard Metal K11A

.11 Door Stops

- a. Overhead Stops and Holders:
 - i. Provide heavy duty Grade 1 surface and concealed overhead stops and holders, size in accordance with manufacturers recommendations, non-hold open stops on fire rated doors, dead stop required at openings with maximum 90-degree limitation.
 - Provide the following:

Division 08 - Openings

- Surface Overhead Stop – Glynn Johnson 90 Series
 - Concealed Overhead Stop – Glynn Johnson 100 Series
- b. Wall Mounted Stops:
 - i. Provide heavy duty cast brass/bronze wall stops with grey, non-marring convex rubber center, metal plate for securing to wall with fasteners and toggle bolts.
 - Provide the following:
 - Wall Stop – CBH 120, 130
 - Wall Stop – Standard Metal S120, S122
- c. Floor Stops:
 - i. Provide heavy duty cast brass/bronze floor stops with grey, non-marring rubber bumper, fasteners and anchors.
 - Provide the following:
 - Floor Stop – CBH 102, 112
 - Floor Stop – Standard Metal S101, S103

.12 Coordinators

- a. Provide heavy duty Grade 1 bar type coordinators, furnish with filler bar and mounting brackets for installing surface mounted door closers and overhead tops. Size as per manufacturers recommendations.
 - Provide the following:
 - Coordinators – Ives COR Series
 - *Use of coordinators shall only be used with approval from CUFMP.*

.13 Thresholds and Gasketing

- a. Thresholds:
 - i. Provide extruded aluminum thresholds as scheduled in hardware sets. Beveled both sides with flat profile. Dimension length to full width of outside frame, cope around soffit of frame. Selection threshold profile and type to be coordinated with specific flooring conditions.
 - Provide the following:
 - Threshold – KN Crowder CT Series
- b. Threshold Stop Strips:
 - i. Provide extruded aluminum threshold lips with flexible silicone seal as scheduled in hardware sets. Dimension to full width of opening, apply to surface of flat threshold against the inside surface of the door.
 - Provide the following:
 - Threshold Stop Strip – KN Crowder CT-40S
- c. Gasketing:
 - i. Provide extruded aluminum 1/4-inch-thick with resilient flexible silicone seal weather strip at exterior openings and interior openings for smoke seals at fire

rated openings and sound seals. Size continuously at head and jambs. Provide resilient flexible silicone rubber seal strips at openings with removable mullions, centered and evenly spaced to make full contact with door.

- Continuous seal to be maintained and hardware to be mounted on top of weather strip
- Provide the following:
 - Weather Strip and Smoke Seal – KN Crowder W-20N, W-20S, W-22
 - Mullion Seal – Jacobs & Thompson 1210 (3.18mm thick x 25.4mm wide)
 - K.N. Crowder Manufacturing Inc product W-DCMB32 or W-DCMB46 Door closer mounting bracket- no substitution

d. Astragals:

- i. Provide flat bar steel astragal at paired openings, 1/8 inch (3mm) x 1-1/2 inch (38mm), sized to full length of doors less 1 inch (25mm).
 - Provide the following:
 - K.N. Crowder W-8SL has silicone weather strip
 - K.N. Crowder W-8-SS
 - Astragal – CBH 498
 - Astragal – Gallery GHS 25-1
 - Astragal – Standard Metal K35

e. Door Bottoms and Sweeps:

- i. Provide surface mounted sweeps of extruded aluminum material, oblong holes for fasteners. Furnish with brush sweep material.
 - Provide the following:
 - Sweep – KN Crowder W-24S, W-33S
 - Provide surface mounted automatic door bottoms of extruded aluminum material with pressure housing seal insert with closed cell sponge neoprene, felt or brush to suit flooring materials or threshold surface. Furnish with adjustable plunger on hinge side of door. Only surface-mounted type acceptable
 - Provide the following:
 - Automatic Door Bottom – KN Crowder CT-50, CT-52
 - *Mortised automatic door bottoms are not permitted.*

.14 Electrified Hardware

a. Electric Strikes:

- i. Provide heavy duty Grade 1 electric strike, stainless steel construction,

UL/cUL listed for both burglar resistance and fire rated openings. Furnish with faceplate option to accommodate specified model and function of lockset, switchable for 12/24VDC.

- Provide the following:

- Electric Strike – HES 1006 – No Smart Pac 3 unless to be scheduled unlocked

- ii. Provide heavy duty Grade 1 electric strike, stainless steel construction, UL/cUL listed for both burglar resistance and fire rated openings, for use with rim exit devices, switchable for 12/24VDC.

- Provide the following:

- Electric Strike – HES 9500 – No Smart Pac 3 unless to be scheduled unlocked, or
- Electric Strike – Von Duprin 6300

- *If required for active/inactive paired opening application with rim exit device, use with HES Fire Rated mounting box.*

b. Magnetic Hold Open:

- ii. Provide magnetic hold open with 35 pound holding force, wall mounted type, vertical location at top of door, minimum projection 2-1/2 inches (64mm) from wall, 12 or 24VDC [Confirm with CUFMP].

- Provide the following:

- Magnetic Hold Open – LCN SEM 7830

- iii. Provide magnetic hold open with 35 pound holding force, floor mounted type [acceptable with written approval from CUFMP], total projection 6-3/4 inches (171mm), 12 or 24VDC [Confirm with CUFMP].

- Provide the following:

- Magnetic Hold Open – LCN SEM 7820

- *Magnetic hold open to be wired in a low voltage configuration, line voltage with a step down transformer/ power supply such as PS 900 Series or equivalent (supplied by Division 26).*

c. Door Position Switches:

- iv. Provide door position switch, concealed mounted, UL/cUL listed for fire rated openings, 25mm (1 inch) in diameter, single pole double throw (SPDT), normally closed, switch rating of 30 volts VDC/VAC and 0.25 amps.

- Provide the following:

- a) Door Position Switch – Honeywell 947H
- b) Door Position Switch – Sentrol 1076
- c) Door Position Switch – Schlage 679-05HM

d. Power Transfers:

- v. Provide power transfers UL/cUL listed for fire rated openings. Furnish with number of wires required for electrified hardware as scheduled and back box.
 - Provide the following:
 - a) Power Transfer – Von Duprin EPT-10
 - b) Power Transfer – Securitron CEPT
 - c) Securitron CEPT

e. Card Readers:

- vi. Supplied by CUFMP.

f. Key Switches:

- vii. Provide flush mounted key switch with stainless steel cover plate with Bi-Colour Red/Green status LED as follows: Red status disarmed, Green status operational. Furnish with integral backing bracket for integration with Medeco mortise cylinder 32mm (1-1/4 inch), UL/CUL listed, switchable 12/14 VDC.
 - Provide the following:
 - Key Switch – Camden CM-1190-712
 - *Key switches are required at openings without card readers to deactivate exterior wall plate switches.*
 - *Key switches are to be mounted on the secure side of the door with security head Torx type fasteners.*
 - *Key switches to be installed at 1200mm (47.25") above finished floor.*

g. Occupancy Annunciator:

- viii. Provide flush mount occupancy annunciator, stainless steel construction, 1-3/8 inches (35mm) square illuminated message visible only when lit, when not lit the message will not be readily legible. The message to read "OCCUPIED/OCCUPE" (Red and Green). Armed colour "RED". Unlocked colour "GREEN". The LED illuminated annunciators shall be constructed so that the message cannot be scratched or removed by vandalism. The LED illuminated annunciators shall be 12/30VDC.
 - Provide the following:
 - Occupancy Annunciator – Camden CM-AF500 one (1) inside and one (1) outside the washroom

h. Occupancy Sensor:

Provide surface mounted occupancy sensor to detect a minimum of 28 inches (711mm) above finished floor, moving at a rate of 2 inches (51mm) per second minimum towards the center of the door, with detection areas described as per ANSI 156.1. The sensor shall provide a maximum field of motion detection 156 inches (3962mm) wide up to 98 inches (2489mm) deep. Microwave activation portion of the sensor shall have bi-directional, unidirectional or motion tracking sensing capabilities and utilize a flat planar antenna. Provide means to adjust the

activation zone vertical angle from 0 to 90 degrees as measured from the face of the sensor and from +15 to -15 degrees measured parallel to the face of the sensor. Adjustments must be made using a hand held remote control.

- Provide the following:
 - Occupancy Sensor - BEA 10EAGLE

i. Relay:

Provide relay of compact design to fit inside door operator case. Furnish with large 3 segment LED display for visual relay confirmation and simple push buttons for ease of programing, support illuminated signage in restroom applications. Programable for interconnection with access control and fire alarms. Shall be heavy duty 3-amp with operating voltage from 12 to 30VDC.

- Provide the following:
 - Relay – Camden CX-33
 - Door Contact to be installed on secure side of room if surface mounted.
 - Must be installed in fail-safe configuration

j. Piezo Sounder:

Provide piezo sounder used as a local or remote alarm sounder for exit delay or door prop alarm. Features to include remote annunciator and powerful 86db sounder.

- Provide the following:
 - Piezo Sounder – Securitron PZ1

k. Acceptable material:

- Camden Emergency Call Kit CX-WEC10

l. Miscellaneous Hardware

ix. Silencers:

Provide silencers of grey rubber material, push in type for use in steel or wood frames, 3ea in each strike jamb, 2ea in each head header, 4ea for Dutch door strike jamb.

- Provide the following:
 - Silencer – Ives SR64, SR65
 - Silencer – Rockwood 608-RKW, 609
 - Silencer – Trimco 1229A, 1229B

PART 3 - MATERIALS

- .1 Provide hardware with finishes conforming to BHMA 156.18.

Division 08 - Openings

- | | | |
|----|-------------------------------------|---|
| a. | 630 Satin Stainless-Steel | Mortise hinges,
locksets, automatic flush bolts, door pulls, overhead stops, push/pull
plates, protection plates, push buttons, key switches, actuators,
occupancy annunciators. |
| b. | 626 Satin Chrome on brass or bronze | Mortise hinges, manual flush bolts, exit
devices, floor/wall stops. |
| c. | 652 Satin Chrome on steel | Mortise hinges. |
| d. | 628 Satin Anodized Aluminum
door | Auxiliary locks, automatic operators,

bottoms, gasketing. |
| e. | 689 Aluminum Powder Coat | Door closers |
| f. | SRI Special Rust Inhibiting Primer | Door closers |
| g. | 719 Mill Finish Aluminum | Thresholds |
| h. | 600 Prime for Paint | Astragals |
| i. | White Plastic | Door contacts |
| j. | Black Plastic | Occupancy Sensor |

PART 4 - KEYING

- a. Keying System: To be coordinated with Carleton University Facilities Management and Planning (FMP).
- b. Keys: Supplied by Carleton University Facilities Management and Planning (FMP).
- c. Keys are the responsibility of the Contractor and a minimum charge of \$1000.00 per key plus all costs associated with any other re-keying of buildings/areas will be levied against the project, at the contractor's expense, for any keys not returned within two (2) weeks of request from Facilities Management and Planning for their return.

Part 5 – Execution

.1 Examination

- a. Prior to door hardware installation, visually inspect doors and frames to ensure they are plumb, level, square, true, securely anchored, and free from defects that would prevent installation of finish hardware.
- b. Confirm doors and frames are correctly sized, handed, fire labeled and prepped for scheduled hardware.
- c. Verify wires are run and ready for power to doors requiring electrified hardware.
- d. Wash down masonry walls, complete painting and staining of doors and frames prior to installation of finish hardware.

- e. Confirm finish flooring is complete at doorways.
- f. Correct conditions that inhibit installation before continuing with work.
- g. Deficiencies to be submitted in writing and signed off on when complete.

.2 Preparation

- a. Steel Doors and Frames: For surface applied door hardware, drill and tap doors and frames according to ANSI/SDI A250.6.
- b. Wood Doors: Comply with DHI WDHS.5 "Recommended Hardware Reinforcement Locations for Mineral Core Wood Flush Doors."

.3 Installation

- a. Use only fasteners furnished by manufacturer for installation. Drill, tap and countersink items not factory pre- pared for fasteners.
- b. Install hardware in compliance with manufacturers written instructions, and DHI publications "Installation Guide for Doors and Hardware", and "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames", and as follows:
 - 1. Locate electrified hinge at second hinge from the bottom of frame.
 - 2. Mount protection plates flush with bottom edge of door.
 - 3. Cylinder and thumb turn door preparations shall be templated as per manufacturers supplied installation template. Use test cylinders prior to installation of permanent cylinders to ensure precise alignment. Any cylinders to be found misaligned, door preparation repairs will be at the Contractors expense.
- c. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work specified in Division 09 Sections. Do not install surface-mounted items until finishes have been completed on substrates involved.
- d. Install fire door and non-fire door assemblies to maintain clearances from door edge to frame, bottom door clearance, and meeting edge of pairs or doors in compliance with NFPA 80. Where panic thresholds are used, allow 3mm (1/8-inch) clearance between bottom of door and threshold.
- e. Mount closers on room side of corridor doors, on inside of exterior doors, on push side of stairwell doors and cross corridor doors to minimize the possibility of damage. All closers to be through bolted on both hollow metal and wood doors. On aluminum doors where top jamb mounting is required, the closer main arm and shoe

is to be through bolted. It is preferred that all door closers installed on aluminum doors be parallel arm mounted. Provide optional thick hub closer shoe #62G for parallel arm mounting installation where clearance of blade stops is required. Use arms, brackets, spacers and plates to accommodate auxiliary hardware.

- f. Automatic door operators and all related electrified hardware shall be installed by an American Association of Automatic Door Manufacturers (AAADM) certified technician.
- g. Wall stops shall be installed wherever possible. Install blocking material for all wall mounted door stops at acceptable height to contact door trim. Where floor stops are installed, their height must accommodate finished floor materials and door undercut, not impede traffic, with manufacturer provided fasteners and anchors. Tap-cons or similar type of fasteners are not permitted.
- h. Install perimeter and meeting stile gasketing after final coat of paint, prior to installation of door closers and exit devices to provide continuous seals. Install door bottoms and threshold stop strips to form continuous seal with threshold when door is closed.
- i. Trim, cope and cut thresholds and saddles neatly to minimally fit the profile of the door frame. Length shall extend to outside dimension of frame width. Set threshold in a bed of mastic sealant or grout, forming a tight seal between the threshold and surface it is set on.
- j. Terminate wiring for low voltage hardware using point to point diagrams. Record colour of wire used in each termination and turn over to Owner as part of Operation and Maintenance (O & M) documents.
- k. Boxed power supplies, back boxes, complete with pull wires shall be provided by Division 26 for door operator systems all access control and electrified hardware. Install all door hardware operational devices at no less than 900mm (35-7/16 inch) and no more than 1200mm (47-1/4 inch) above finished floor.

.4 Field Quality Control

- a. Prior to substantial completion, retain the services of an AHC or EHC to inspect openings. Replace or repair with new, hardware found to be inoperative and not complying with Submittals. Verify doors open and close smoothly without rubbing or catching with positive latching where scheduled. Verify fire rated doors are installed with clearances conforming to NFPA80.
- b. Test electrified hold open devices tied into fire alarm system to confirm release upon activations of fire alarm. Test delayed egress systems to ensure time delay and release are in compliance with local code requirements. Test electrified hardware and access control systems operate as directed in mode of operation. Where

hardware is found to be inoperable, repair or replace with new.

.5 Demonstration

- a. After building is occupied demonstrate effectiveness of mechanical and electrical hardware, and electronic hardware systems, including adjustment and maintenance procedures to project engineer and building lock-smith. Record names of those present and submit to consultant verifying completion.

.6 Adjusting and Cleaning

- a. Upon substantial completion, after balance of heating and ventilation equipment, make final adjustments to door closers, automatic operators, door controls and latching hardware to ensure doors fully close and latch.
- b. Clean and polish all exposed hardware surfaces in accordance with manufacturers recommended procedures.
- c. Clean and remove pencil or tool marks from adjacent surfaces damaged or soiled by work of this Section.
- d. Recycle cardboard boxes and paper products used in packaging and transport of finish hardware.

.7 Protection

- a. Remove installed hardware prior to painting, finishing and modifying door and frame and reinstall once complete. Wrap or mask exposed hardware with kraft paper or bubble wrap that cannot be removed to avoid exposure to paint, solvents and abuse.
- b. Protect fire labels on hardware with plastic or kraft paper to avoid voiding label.
- c. Remove field and factory applied paper, plastic and film at substantial completion.
- d. Repair or replace hardware damaged during construction prior to date of substantial completion.

.8 Door Hardware Schedule

The following pages is a hardware schedule template that is to be provided to CUFMP prior to releasing for tender for review. Complete with itemized numbering, door number, description of door location, door handing, size of door, material of door and frame, door type (legend included in schedule), fire rating duration of all labeled doors along with details and notes of hardware installation. The consultant shall provide a detailed hardware schedule to CUFMP with each drawing review submission 33%, 66% and 99% complete prior to issuing for tender.

HW SET #01

1 DBL DOOR D1002	ELEVATOR LOBBY 1002 FROM TUNNEL	RHRA
2/950 x 2150 x 45	HMD/HMF	
TYPE H	45 MIN	90 DEG

6ea	HINGES	FBB199 127 X 101 X NRP	630	ST
1ea	EXIT DEVICE	98L-F X 996L-03 X 950mm	626	VD
1ea	EXIT DEVICE	98EO-F X 950mm	626	VD
1ea	REM. MULLION	KR9954	689	VD
2ea	CYLINDER	MEDECO - SUPPLIED BY OWNER	626	ME
1ea	ELECTRIC STRIKE	9500 X 12/24VDC	630	HE
2ea	CLOSER	4040XP PA-EDA X TBGN	689	LC
* CLOSER TO BE SET TO SIZE 3.				
2ea	WALL STOP	S122	626	SM
2ea	KICK PLATE	K10A 203 X 900 X SMOH	630	SM
1 set	SMOKE SEAL	W-20S X 1@1900/2@2150	628	KN
1ea	SMOKE SEAL	1210 X 2150	BLK	JT
* INSTALL ON EXTERIOR FACE OF MULLION, EVENLY SPACED TO MAKE FULL CONTACT WITH DOOR.				
2ea	SILENCERS	SUPPLIED BY FRAME MANUFACTURER		
2ea	DOOR CONTACT	947	WHT	HW
1ea	CARD READER	SUPPLIED BY OWNER		
1 set	ELEVATION / POINT TO POINT DRAWINGS			

DESCRIPTION OF OPERATION:

- * DOOR IS NORMALLY CLOSED AND LOCKED.
- * PRESENTING A VALID CREDENTIAL TO THE READER OR EMERGENCY KEY IN LOCKSET MOMENTARILY UNLOCKS THE DOOR ALLOWING ENTRY.
- * DOOR CAN BE LEFT UNLOCKED BY ACCESS CONTROL OR EMERGENCY KEY.
- * ACTIVATION OF FIRE ALARM PREVENTS ACCESS CONTROL FROM UNLOCKING DOOR.
- * FREE EGRESS AT ALL TIMES.

Division 08 - Openings

HW SET #02

1 SGL DOOR D1020		CORRIDOR 1001 TO STUDENT RESEARCH CENTRE 1020		LH
1 SGL DOOR D1021		CORRIDOR 1001 TO ACTIVE LEARNING LAB 1021		RH
1 SGL DOOR D1030A		MAIN LOBBY 1000 TO BEHAVIORAL LAB 1030A		RH
1 SGL DOOR D5011		CORRIDOR 5002 TO PROFESSIONAL CLASSROOM 5011		LH
1 SGL DOOR D6010		CORRIDOR 6002 TO CLASSROOM 6010		LH
950 X 2150 X 45		HMD/HMF		
TYPE N				90 DEG
15a	HINGES	FBB168 127 X 101 X NRP	652	ST
5ea	LOCKSET	ML2055 L/C X LWA	626	CO
5ea	CYLINDER	MEDECO - SUPPLIED BY OWNER	626	ME
5ea	ELECTRIC STRIKE	1006KM X 12/24VDC	630	HE
* PREP ONLY FOR FUTURE USE. INSTALL CONTACT AS FILLER UNTIL REQUIRED.				
5ea	FILLER PLATE	AF260 X MST PREP X 42.8mm RETURN	630	DJ
5ea	CLOSER	4040XP REG X TBGN	689	LC
* CLOSER TO BE SET TO SIZE 3.				
5ea	WALL STOP	S122	626	SM
5ea	KICK PLATE	K10A 203 X 912 X SMOH	630	SM
15ea	SILENCERS	SUPPLIED BY FRAME MANUFACTURER		
5ea	DOOR CONTACT	947	WHT	HW
* PREP ONLY FOR FUTURE USE. INSTALL CONTACT AS FILLER UNTIL REQUIRED.				
5ea	CARD READER	SUPPLIED BY OWNER FOR FUTURE USE		
1 set	ELEVATION / POINT TO POINT DRAWINGS			

NOTES:

- * DOOR AND FRAME TO BE PREPPED FOR ELECTRIFIED HARDWARE LISTED ABOVE FOR FUTURE USE.
- * PROVIDE CONDUIT IN DOOR AND FRAME FOR FUTURE ACCESS CONTROL.

Division 08 - Openings

HW SET #03

1 SGL DOOR D1030		MAIN LOBBY 1000 FROM WAITING AREA 1030	RHR	
950 X 2150 X 45		HMD/HMF		
TYPE I			90 DEG	
3ea	HINGES	FBB168 127 X 101 X NRP	652	ST
1ea	LOCKSET	ML2055 L/C X LWA	626	CO
1ea	CYLINDER	MEDECO - SUPPLIED BY OWNER	626	ME
1ea	ELECTRIC STRIKE	1006KM X 12/24VDC	630	HE
1ea	CLOSER	4040XP REG X TBGN	689	LC
* CLOSER TO BE SET TO SIZE 3.				
1ea	WALL STOP	S122	626	SM
1ea	KICK PLATE	K10A 203 X 912 X SMOH	630	SM
3ea	SILENCERS	SUPPLIED BY FRAME MANUFACTURER		
1ea	DOOR CONTACT	947	WHT	HW
1ea	CARD READER	SUPPLIED BY OWNER FOR FUTURE USE		
1 set	ELEVATION / POINT TO POINT DRAWINGS			

DESCRIPTION OF OPERATION:

- * DOOR IS NORMALLY CLOSED AND LOCKED.
- * PRESENTING A VALID CREDENTIAL TO THE READER OR EMERGENCY KEY IN LOCKSET MOMENTARILY UNLOCKS THE DOOR ALLOWING ENTRY.
- * DOOR CAN BE LEFT UNLOCKED BY ACCESS CONTROL OR EMERGENCY KEY.
- * ACTIVATION OF FIRE ALARM PREVENTS ACCESS CONTROL FROM UNLOCKING DOOR.
- * FREE EGRESS AT ALL TIMES.

Division 08 - Openings

HW SET #04

1 SGL DOOR D2020E		ELEVATOR LOBBY 2001 FROM INNOV. ACCELERATOR 2020		RHR
1 SGL DOOR D2020F		ELEVATOR LOBBY 2001 FROM INNOV. ACCELERATOR 2020		LHR
950 X 2150 X 45		HMD/HMF		
TYPE N				90 DEG
8ea	HINGES	FBB168 127 X 101 X NRP	652	ST
2ea	LOCKSET	ML2055 L/C X LWA	626	CO
2ea	CYLINDER	MEDECO - SUPPLIED BY OWNER	626	ME
2ea	ELECTRIC STRIKE	1006KM X 12/24VDC	630	HE
* PREP ONLY FOR FUTURE USE.				
2ea	FILLER PLATE	AF260 X MST PREP X 42.8mm RETURN	630	DJ
2ea	AUTOMATIC OPERATOR	9540 X LESS ON/OFF SWITCH	689	LC
4ea	PUSH PLATE SWITCH	CM-7536/4	630	CM
2ea	KEY SWITCH	CM-1190-7212 (TO CONTROL EXT. PUSH PLATE)	630	CM
2ea	WALL STOP	S122	626	SM
2ea	KICK PLATE	K10A 203 X 912 X SMOH	630	SM
6ea	SILENCERS	SUPPLIED BY FRAME MANUFACTURER		
2ea	DOOR CONTACT	947	WHT	HW
* PREP ONLY FOR FUTURE USE. INSTALL CONTACT AS FILLER UNTIL REQUIRED.				
2ea	CARD READER	SUPPLIED BY OWNER FOR FUTURE USE		
1 set	ELEVATION / POINT TO POINT DRAWINGS			

NOTES:

* DOOR AND FRAME TO BE PREPPED FOR ELECTRIFIED HARDWARE LISTED ABOVE FOR FUTURE USE.

* PROVIDE CONDUIT IN DOOR AND FRAME FOR FUTURE ACCESS CONTROL AS NOTED ABOVE.

DESCRIPTION OF OPERATION:

* DOOR IS NORMALLY CLOSED AND LOCKED.

* WHEN KEY SWITCH IS IN THE UNLOCKED POSITION THE PUSH PLATE SWITCH WILL CAUSE THE AUTOMATIC OPERATOR TO OPEN THE DOOR.

* ACTIVATION OF FIRE ALARM PREVENTS THE AUTOMATIC OPERATOR FROM CYCLING.

* FREE EGRESS AT ALL TIMES.

Division 08 - Openings

HW SET #05

1 SGL DOOR D1081	CORRIDOR 1001 TO UNIVERSAL WASHROOM1081	LH
1 SGL DOOR D1082	CORRIDOR 1001 TO UNIVERSAL WASHROOM1082	RH
950 X 2440 X 45	WD/HMF	
TYPE G		90 DEG

8ea	HINGES	FBB168 127 X 101 X NRP	652	ST
2ea	LOCKSET	ML2057 L/C X LWA	626	CO
4ea	CYLINDER	MEDECO - SUPPLIED BY OWNER	626	ME
2ea	ELECTRIC STRIKE	1006KM X 12/24VDC	630	HE
2ea	AUTOMATIC OPERATOR	9530 X LESS ON/OFF SWITCH	689	LC
2ea	WALL STOP	S122	626	SM
2ea	KICK PLATE	K10A 203 X 962 X SMOH	630	SM
6ea	SILENCERS	SUPPLIED BY FRAME MANUFACTURER		
4ea	PUSH PLATE SWITCH	CM-60/2	630	CM
2ea	WASHROOM KIT	CX-WC10	630	CM
2ea	KEY SWITCH	CM-1190-7212 (TO CONTROL EXT. PUSH PLATE)	630	CM
2ea	OCCUPANCY ANNUNCIATOR	CM-AF500	630	CM
2ea	OCCUPANCY SENSOR	10EAGLE	BLK	BE
2ea	RELAY	TM-9	BLK	SN
1 set	ELEVATION / POINT TO POINT DRAWINGS			

DESCRIPTION OF OPERATION:

- * DOOR IS NORMALLY CLOSED AND UNLOCKED.
- * CORRIDOR SIDE PUSH PLATE WILL CAUSE THE AUTOMATIC OPERATOR TO OPEN THE DOOR.
- * WHEN INSIDE THE WASHROOM PRESSING THE "PUSH TO LOCK" BUTTON LOCKS THE DOOR AND DISABLES THE CORRIDOR SIDE PUSH PLATE SWITCH.
- * INDICATOR LIGHT ON CORRIDOR SIDE IS ILLUMINATED WHEN THE DOOR IS LOCKED.
- * OCCUPANCY SENSOR WILL DEACTIVATE THE CORRIDOR SIDE PUSH PLATE AND ACTIVATE THE ANNUNCIATOR INFORMING OTHERS THAT THE WASHROOM IS IN USE.
- * PRESSING THE INSIDE PUSH PLATE SWITCH OR OPENING THE DOOR MANUALLY RETURNS THE DOOR TO AN UNLOCKED CONDITION AND THEN ALLOWS THE CORRIDOR SIDE PUSH PLATE SWITCH TO ONCE AGAIN OPEN THE DOOR.
- * FREE EGRESS AT ALL TIME.

Division 08 - Openings

HW SET #06

1 SGL DOOR D1010C		ELECTRICAL ROOM 1010B TO SUBSTATION ROOM 1010C		LH
1 SGL DOOR D1010G		CORRIDOR 1001 TO MECHANICAL 1010		LH
950 X 2440 X 45		HMD/HMF		
TYPE I		45 MIN		90 DEG
8ea	HINGES	FBB191 127 X 101 X NRP	630	ST
2ea	LOCKSET	ML2057 L/C X LWA	626	CO
2ea	CYLINDER	MEDECO - SUPPLIED BY OWNER	626	ME
2ea	CLOSER	4040XP REG X TBGN	689	LC
* CLOSER TO BE SET TO SIZE 3.				
2ea	WALL STOP	S122	626	SM
2ea	KICK PLATE	K10A 203 X 912 X SMOH	630	SM
2 set	SMOKE SEAL	W-20S X 1@950/2@2440	628	KN
6ea	SILENCERS	SUPPLIED BY FRAME MANUFACTURER		

HW SET #07

1 SGL DOOR D1083		CORRIDOR 1001 TO JANITOR 1083	LH	
950 X 2150 X 45		HMD/HMF		
TYPE I		0 MIN	90 DEG	
3ea	HINGES	FBB179 127 X 101 X NRP	652	ST
1ea	LOCKSET	ML2057 L/C X LWA	626	CO
1ea	CYLINDER	MEDECO - SUPPLIED BY OWNER	626	ME
1ea	CLOSER	4040XP REG X TBGN	689	LC
* CLOSER TO BE SET TO SIZE 3.				
1ea	WALL STOP	S122	626	SM
1ea	KICK PLATE	K10A 203 X 912 X SMOH	630	SM
1 set	SMOKE SEAL	W-20S X 1@950/2@2150	628	KN
1ea	DOOR BOTTOM	CT-50 X 950	628	KN
3ea	SILENCERS	SUPPLIED BY FRAME MANUFACTURER		

Division 08 - Openings

HW SET #08

1 DBL DOOR D1010F		CORRIDOR 1001 TO MECHANICAL 1010	RHA	
2/950 X 2440 X 45		HMD/HMF		
TYPE H		45 MIN	90 DEG	
8ea	HINGES	FBB179 127 X 101 X NRP	652	ST
1ea	LOCKSET	ML2057 L/C X LWA X SB134	626	CO
2ea	CYLINDER	MEDECO - SUPPLIED BY OWNER	626	ME
2ea	CLOSER	4040XP REG X TBGN X ST1630	689	LC
* CLOSER TO BE SET TO SIZE 3.				
2ea	FLUSH BOLTS	FB458 X 610 ROD	626	IV
1ea	FLUSH BOLTS	FB458	626	IV
1ea	OVERHEAD STOP	104S X 90 DEG	630	GJ
* INSTALL ON INACTIVE DOOR.				
1ea	WALL STOP	S122	626	SM
2ea	KICK PLATE	K10A 203 X 900 X SMOH	630	SM
1 set	SMOKE SEAL	W-20S X 1@1900/2@2440	628	KN
1ea	ASTRAGAL	K35 X 2675 X TMS	GYP	SM
3ea	SILENCERS	SUPPLIED BY FRAME MANUFACTURER		

NOTES:

* USE OF MANUAL FLUSH BOLTS TO BE APPROVED BY AUTHORITY HAVING JURISDICTION (AHJ).

Division 08 - Openings

HW SET #09

1 SGL DOOR D1000		STAIR D 1094 FROM MAIN LOBBY 1000	LHR	
1200 X 2440 X 45		HMD/HMF		
TYPE I		45 MIN	90 DEG	
4ea	HINGES	FBB168 127 X 101 X NRP	652	ST
1ea	EXIT DEVICE	98L-F x 996L-03 X 1220mm	626	VD
1ea	CYLINDER	MEDECO - SUPPLIED BY OWNER	626	ME
1ea	ELECTRIC STRIKE	9500 X 12/24VDC	630	HE
1ea	AUTOMATIC OPERATOR	9540 X LESS ON/OFF SWITCH	689	LC
2ea	PUSH PLATE SWITCH	CM-7536/4	630	CM
1ea	RELAY	CX-33		CM
1ea	OVERHEAD STOP	106S X 90 DEG	630	GJ
1ea	KICK PLATE	K10A 203 X 1162 X SMOH	630	SM
1 set	SMOKE SEAL	W-20S X 1@1200/2@2440	628	KN
3ea	SILENCERS	SUPPLIED BY FRAME MANUFACTURER		
1ea	DOOR CONTACT	947	WHT	HW
1ea	CARD READER	SUPPLIED BY OWNER		
1 set	ELEVATION / POINT TO POINT DRAWINGS			

DESCRIPTION OF OPERATION:

- * DOOR IS NORMALLY CLOSED AND LOCKED.
- * PRESENTING A VALID CREDENTIAL TO THE READER OR EMERGENCY KEY IN LOCKSET MOMENTARILY UNLOCKS THE DOOR ALLOWING ENTRY.
- * ONCE UNLOCKED THE PUSH PLATE SWITCH WILL CYCLE THE OPERATOR TO OPEN THE DOOR.
- * DOOR CAN BE LEFT UNLOCKED BY ACCESS CONTROL.
- * EXTERIOR PUSH PLATE CONTROLLED BY ACCESS CONTROL SOFTWARE.
- * ACTIVATION OF FIRE ALARM PREVENTS ACCESS CONTROL FROM UNLOCKING DOOR AND DEACTIVATES THE DOOR OPERATOR CLOSING THE DOOR.
- * FREE EGRESS AT ALL TIMES.

Division 08 - Openings

HW SET #10

1 SGL DOOR D1091B		STAIR A 1091 FROM VESTIBULE 1091A	RHR	
950 X 2134 X 45		HMD/HMF		
TYPE I		45 MIN	90 DEG	
3ea	HINGES	FBB199 127 X 101 X NRP	630	ST
1ea	EXIT DEVICE	98L-F X 996L-03 x 950mm	626	VD
1ea	CYLINDER	MEDECO - SUPPLIED BY OWNER	626	ME
1ea	CLOSER	4040XP PA-EDA X TBGN	689	LC
* CLOSER TO BE SET TO SIZE 4.				
1ea	WALL STOP	S122	626	SM
1ea	KICK PLATE	K10A 203 X 912 X SMOH	630	SM
1 set	SMOKE SEAL	W-20S X 1@950/2@2134	628	KN
3ea	SILENCERS	SUPPLIED BY FRAME MANUFACTURER		

HW SET #11

1 SGL DOOR D2006		FOOD SERVICE 2010 TO CORRIDOR 2006 HMD/HMF	LH	
950 X 2150 X TRANSOM X 45 TYPE I		45 MIN	90 DEG	
3ea	HINGES	FBB199 127 X 101 X NRP	630	ST
1ea	PASSAGE SET	ML2010 X LWA	626	CO
1ea	CLOSER	4040XP REG X TBGN	689	LC
* CLOSER TO BE SET TO SIZE 3.				
1ea	WALL STOP	S122	626	SM
1ea	BUMPER PLATE	K10A 762 X 912 X SMOH	630	SM
1 set	SMOKE SEAL	W-20S X 1@950/2@2150	628	KN
3ea	SILENCERS	SUPPLIED BY FRAME MANUFACTURER		

Division 08 - Openings

HW SET #12

1 SGL DOOR D2012A		PREP KITCHEN 2012 FROM STORAGE 2012A	LHR	
850 X 2150 X 45		HMD/HMF		
TYPE I			90 DEG	
4ea	HINGES	FBB191 114 X 101 X NRP	630	ST
1ea	LOCKSET	ML2057 L/C X LWA	626	CO
1ea	CYLINDER	MEDECO - SUPPLIED BY OWNER	626	ME
1ea	WALL STOP	S122	626	SM
3ea	SILENCERS	SUPPLIED BY FRAME MANUFACTURER		

HW SET #13

1 SGL DOOR D2082		CORRIDOR 2002 TO MEN'S WC 2082	LH	
1 SGL DOOR D2083		CORRIDOR 2002 TO WOMEN'S WC 2083	RH	
1 SGL DOOR D3082		CORRIDOR 3002 TO MEN'S WC 3082	LH	
1 SGL DOOR D3083		CORRIDOR 3002 TO WOMEN'S WC 3083	RH	
1 SGL DOOR D4082		CORRIDOR 4002 TO MEN'S WC 4082	LH	
1 SGL DOOR D4083		CORRIDOR 4002 TO WOMEN'S WC 4083	RH	
950 X 2440 X 45		WD/HMF		
TYPE G			90 DEG	
24ea	HINGES	FBB168 127 X 101 X NRP	652	ST
6ea	PUSH PULL	3012-2 X 3012-2 #5	630	SM
6ea	DEADBOLT	ML2017 L/C	626	CO
12ea	CYLINDER	MEDECO - SUPPLIED BY OWNER	626	ME
6ea	KEY SWITCH	CM-1190-7212 (TO CONTROL EXT. PUSH PLATE)	630	CM
* INSTALL KEY SWITCH ON SECURE SIDE OF DOOR.			LC	
6ea	AUTOMATIC OPERATOR	9530 X LESS ON/OFF SWITCH	689	SM
6ea	WALL STOP	S122	626	CM
6ea	KICK PLATE	K10A 203 X 912 X SMOH	630	
12ea	PUSH PLATE SWITCH	CM-7536/4	630	
18ea	SILENCERS	SUPPLIED BY FRAME MANUFACTURER		

DESCRIPTION OF OPERATION:

* DOOR IS NORMALLY CLOSED.

* WHEN KEY SWITCH IS IN THE UNLOCKED POSITION THE PUSH PLATE SWITCH WILL BE ENABLED. PUSHING THE PLATE WILL OPEN THE DOOR.

* FREE EGRESS AT ALL TIME.

Division 08 - Openings

HW SET #14

1 SGL DOOR D2084		CORRIDOR 2002 TO LAN ROOM 2084	RH	
860 X 2440 X 45		WD/HMF		
TYPE G			90 DEG	
4ea	HINGES	FBB179 114 X 101 X NRP	652	ST
1ea	LOCKSET	ML2057 L/C X LWA	626	CO
1ea	CYLINDER	MEDECO - SUPPLIED BY OWNER	626	ME
1ea	ELECTRIC STRIKE	1006KM X 12/24VDC	630	HE
1ea	CLOSER	4040XP REG X TBGN	689	LC
* CLOSER TO BE SET TO SIZE 3.				
1ea	WALL STOP	S122	626	SM
1ea	KICK PLATE	K10A 203 X 822 X SMOH	630	SM
3ea	SILENCERS	SUPPLIED BY FRAME MANUFACTURER		
1ea	DOOR CONTACT	947	WHT	HW
1ea	CARD READER	SUPPLIED BY OWNER		
1 set	ELEVATION / POINT TO POINT DRAWINGS			

DESCRIPTION OF OPERATION:

- * DOOR IS NORMALLY CLOSED AND LOCKED.
- * PRESENTING A VALID CREDENTIAL TO THE READER OR EMERGENCY KEY IN LOCKSET MOMENTARILY UNLOCKS THE DOOR ALLOWING ENTRY.
- * DOOR CAN BE LEFT UNLOCKED BY ACCESS CONTROL.
- * FREE EGRESS AT ALL TIMES.

HW SET #15

1 SGL DOOR D3014A		UNDERGRADUATE OFFICE 3014 TO ASSOCIATE DEAN 3014A	RH	
1 SGL DOOR D3014B		UNDERGRADUATE OFFICE 3014 TO UG PROG. STAFF 3014B	LH	
1 SGL DOOR D3014C		UNDERGRADUATE OFFICE 3014 TO UG PROG. STAFF 3014C	RH	
1 SGL DOOR D3014D		UNDERGRADUATE OFFICE 3014 TO UG PROG. STAFF 3014D	LH	
950 X 2440 X 45		WD/HMF		
TYPE G			90 DEG	
16ea	HINGES	FBB179 127 X 101 X NRP	652	ST
4ea	LOCKSET	ML2051 L/C X LWA	626	CO
4ea	CYLINDER	MEDECO - SUPPLIED BY OWNER	626	ME
4ea	WALL STOP	S122	626	SM
12ea	SILENCERS	SUPPLIED BY FRAME MANUFACTURER		

Division 08 - Openings

HW SET #16

1 SGL DOOR D3022	MAIN LOBBY 3000 TO SEMINAR ROOM 3022	RH
1 SGL DOOR D3024	MAIN LOBBY 3000 TO SEMINAR ROOM 3024	LH
1 SGL DOOR D3032	MAIN LOBBY 3000 TO BREAKOUT ROOM 3032	LH
1 SGL DOOR D3034	MAIN LOBBY 3000 TO BREAKOUT ROOM 3034	RH
1 SGL DOOR D3036	MAIN LOBBY 3000 TO BREAKOUT ROOM 3036	RH
1 SGL DOOR D3038	MAIN LOBBY 3000 TO SEMINAR ROOM 3038	RH
1 SGL DOOR D3040B	MAIN LOBBY 3000 TO CLASSROOM 3040B	RHR
1 SGL DOOR D3042	MAIN LOBBY 3000 TO BREAKOUT ROOM 3042	RH
1 SGL DOOR D3044	MAIN LOBBY 3000 TO SEMINAR ROOM 3044	RH
1 SGL DOOR D3050A	MAIN LOBBY 3000 TO CLASSROOM 3050A	RH
1 SGL DOOR D4022	MAIN LOBBY 4000 TO SEMINAR ROOM 4022	RH
1 SGL DOOR D4024	MAIN LOBBY 4000 TO SEMINAR ROOM 4024	LH
1 SGL DOOR D4032	MAIN LOBBY 4000 TO BREAKOUT ROOM 4032	LH
1 SGL DOOR D4034	MAIN LOBBY 4000 TO BREAKOUT ROOM 4034	RH
1 SGL DOOR D4036	MAIN LOBBY 4000 TO BREAKOUT ROOM 4036	RH
1 SGL DOOR D4038	MAIN LOBBY 4000 TO SEMINAR ROOM 4038	RH
1 SGL DOOR D4042	MAIN LOBBY 4000 TO BREAKOUT ROOM 4042	RH
1 SGL DOOR D4044	MAIN LOBBY 4000 TO SEMINAR ROOM 4044	RH
950 X 2440 X TRANSOM X 45	HMD/HMF	
TYPE I	0 MIN	90 DEG

72ea	HINGES	FBB179 127 X 101 X NRP	652	ST
18ea	LOCKSET	ML2055 L/C X LWA	626	CO
18ea	CLOSER	4040XP REG X TBGN	689	LC
* CLOSER TO BE SET TO SIZE 3.				
18ea	CYLINDER	MEDECO - SUPPLIED BY OWNER	626	ME
18ea	WALL STOP	S122	626	SM
18ea	KICK PLATE	K10A 203 X 912 X SMOH	630	SM
18 set	SMOKE SEAL	W-205 X 1@950/2@3000	628	KN
18ea	DOOR BOTTOM	CT-50 X 950	628	KN
54ea	SILENCERS	SUPPLIED BY FRAME MANUFACTURER		

Division 08 - Openings

HW SET #17

1 SGL DOOR D4010B		VESTIBULE 4010A FROM CLASSROOM 4010	LHR	
950 X 2440 X 45		WD/HMF		
TYPE F			90 DEG	
4ea	HINGES	FBB168 127 X 101 X NRP	652	ST
1ea	EXIT DEVICE	LD98L X 996L-03 X LESS STRIKE X 950mm	626	VD
2ea	CYLINDER	MEDECO - SUPPLIED BY OWNER	626	ME
1ea	ELECTRIC STRIKE	9500 X 12/24VDC	630	HE
1ea	AUTOMATIC OPERATOR	9540 X LESS ON/OFF SWITCH	689	LC
2ea	PUSH PLATE SWITCH	CM-7536/4	630	CM
1ea	KEY SWITCH	CM-1190-7212 (TO CONTROL EXT. PUSH PLATE)	630	CM
* INSTALL KEY SWITCH ON SECURE SIDE OF DOOR.				
1ea	WALL STOP	S122	626	SM
1ea	KICK PLATE	K10A 203 X 912 X SMOH	630	SM
3ea	SILENCERS	SUPPLIED BY FRAME MANUFACTURER		
1 set	ELEVATION / POINT TO POINT DRAWINGS			

DESCRIPTION OF OPERATION:

- * DOOR IS NORMALLY CLOSED AND LOCKED.
- * WHEN KEY SWITCH IS IN THE UNLOCKED POSITION THE PUSH PLATE SWITCH WILL BE ENABLED. PUSHING THE PLATE WILL OPEN THE DOOR.
- * ACTIVATION OF FIRE ALARM PREVENTS THE AUTOMATIC OPERATOR FROM CYCLING.
- * FREE EGRESS AT ALL TIMES BY PUSHING ON THE EXIT DEVICE.

Division 08 - Openings

HW SET #18

1 SGL DOOR D2091B		EXTERIOR FROM STAIR A 2019	RHR	
1067 X 2440 X 45		HMD/HMF		
TYPE I			90 DEG	
4ea	HINGES	FBF199 127 X 101 X NRP	626	ST
1ea	EXIT DEVICE	LD98L x 996L-03 X LESS STRIKE X 1067mm	626	VD
1ea	CYLINDER	MEDECO - SUPPLIED BY OWNER	626	ME
1ea	ELECTRIC STRIKE	9500 X 12/24VDC	630	HE
1ea	AUTOMATIC OPERATOR	9540 X LESS ON/OFF SWITCH	689	LC
1ea	OVERHEAD STOP	105S X 90 DEG	630	GJ
1ea	KICK PLATE	K10A 203 X 1017 SMOH	630	SM
1ea	WEATHER STRIP	W-20S X 1@1067/ 2@2980	628	KN
1ea	SWEEP	W-24S X 1067	628	KN
1ea	THRESHOLD	CT-408 X 1067	628	KN
* THRESHOLD TO BE COPED AROUND FRAME, GROUTED IN PLACE AND CAULKED.				
3ea	SILENCERS	SUPPLIED BY FRAME MANUFACTURER		
1ea	DOOR CONTACT	947	WHT	HW
1ea	REQUEST TO EXIT	T-REX	WHT	KT
1ea	PIEZO SOUNDER	PZI	630	SN
1 set	ELEVATION / POINT TO POINT DRAWINGS			

DESCRIPTION OF OPERATION:

- * DOOR IS NORMALLY CLOSED AND LOCKED.
- * ACTIVATION OF FIRE ALARM OPENS THE DOOR FOR STAIRWELL PRESSURIZATION.
- * FREE EGRESS AT ALL TIMES BY PUSHING ON THE EXIT DEVICE.

Division 08 - Openings

HW SET #19

1 SGL DOOR D2020A	INNOV. ACCELERATOR 2020 TO RESEARCH PROJECTS 2020A	LH
1 SGL DOOR D2020B	INNOV. ACCELERATOR 2020 TO RESEARCH PROJECTS 2020B	RH
1 SGL DOOR D2020C	INNOV. ACCELERATOR 2020 TO RESEARCH PROJECTS 2020C	LH
1 SGL DOOR D2020D	INNOV. ACCELERATOR 2020 TO RESEARCH PROJECTS 2020D	RH
950 X 2440 X TRANSOM X 45	WD/HMF	
TYPE G		90 DEG

16ea	HINGES	FBB179 127 X 101 X NRP	652	ST
4ea	PASSAGE SET	ML2010 X LWA	626	CO
4ea	WALL STOP	S122	626	SM
12ea	SILENCERS	SUPPLIED BY FRAME MANUFACTURER		

HW SET #20

1 SGL DOOR D2000A	EXTERIOR FROM ENTRANCE VESTIBULE 2000A EXTERIOR	RHR
1 SGL DOOR D2000G	FROM ENTRANCE VESTIBULE 2000A	LHR
1236 X 2440 X 57	ALD/ALF	
TYPE B		90 DEG

8ea	HINGES	FBB199 127 X 101 X NRP	626	ST
2ea	DOOR PULL/PUSH BAR	3012-2 X 6046-2 X 4B MTG	630	SM
2ea	AUTOMATIC OPERATOR	9540 X LESS ON/OFF SWITCH	689	LC
* ENSURE SUFFICIENT ACCESS AT CEILING TO SERVICE OPERATOR.				
4ea	PUSH PLATE SWITCH	CM-7536/4	630	CM
2ea	KEY SWITCH	CM-1190-7212 (TO CONTROL EXT. PUSH PLATE)	630	CM
* INSTALL KEY SWITCH ON SECURE SIDE OF DOOR.				
2ea	OVERHEAD STOP	1065 X 90 DEG	630	GJ
2ea	WEATHER STRIP	BY ALUMINUM DOOR MANUFACTURER		
2ea	SWEEP	BY ALUMINUM DOOR MANUFACTURER	628	KN
2ea	THRESHOLD	CT-408 X 1236	628	KN
* THRESHOLD TO BE COPED AROUND FRAME, GROUTED IN PLACE AND CAULKED.				
2ea	DOOR CONTACT	947	WHT	HW
1 set	ELEVATION / POINT TO POINT DRAWINGS			

DESCRIPTION OF OPERATION:

* DOOR IS NORMALLY CLOSED.

* WHEN KEY SWITCH IS IN THE UNLOCKED POSITION THE PUSH PLATE SWITCH WILL BE ENABLED. PUSHING THE PLATE WILL OPEN THE DOOR.

* FREE EGRESS AT ALL TIMES BY PUSHING ON THE PUSH BAR.

Division 08 - Openings

HW SET #21

1 SGL DOOR D2000C	VESTIBULE 2000A FROM MAIN LOBBY 2000	RHR
1 SGL DOOR D2000J	VESTIBULE 2000B FROM MAIN LOBBY 2000	RHR
1236 X 2770 X 45	ALD/ALF	
TYPE B		90 DEG

10ea	HINGES	FBB199 127 X 101 X NRP	630	ST
2ea	EXIT DEVICE	LD98L X 996L-03 X LESS STRIKE X 1200mm	626	VD
2ea	CYLINDER	MEDECO - SUPPLIED BY OWNER	626	ME
2ea	ELECTRIC STRIKE	9500 X 12/24VDC	630	HE
2ea	AUTOMATIC OPERATOR	9540 X LESS ON/OFF SWITCH	689	LC
* ENSURE SUFFICIENT ACCESS AT CEILING TO SERVICE OPERATOR.				
4ea	PUSH PLATE SWITCH	CM-7536/4	630	CM
2ea	OVERHEAD STOP	106S X 90 DEG	630	GJ
2ea	WEATHER STRIP	BY ALUMINUM DOOR MANUFACTURER		
2ea	SWEEP	BY ALUMINUM DOOR MANUFACTURER	628	KN
2ea	DOOR CONTACT	947	WHT	HW
2ea	CARD READER	SUPPLIED BY OWNER		
1 set	ELEVATION / POINT TO POINT DRAWINGS			

DESCRIPTION OF OPERATION:

- * DOOR IS NORMALLY CLOSED.
- * PRESENTING A VALID CREDENTIAL TO THE READER OR EMERGENCY KEY IN EXIT DEVICE TRIM MOMENTARILY UNLOCKS THE DOOR ALLOWING ENTRY.
- * DOOR CAN BE LEFT UNLOCKED BY ACCESS CONTROL OR EMERGENCY KEY.
- * ACTIVATION OF FIRE ALARM PREVENTS ACCESS CONTROL FROM UNLOCKING DOOR.
- * FREE EGRESS AT ALL TIMES.

Division 08 - Openings

HW SET #22

1 SGL DOOR D3020A	MAIN LOBBY 3000 FROM CLASSROOM 3020	LHR
1 SGL DOOR D3030A	MAIN LOBBY 3000 FROM CLASSROOM 3030	LHR
1 SGL DOOR D3040A	MAIN LOBBY 3000 FROM CLASSROOM 3040	LHR
1 SGL DOOR D4020A	MAIN LOBBY 4000 FROM CLASSROOM 4020	LHR
1 SGL DOOR D4030A	MAIN LOBBY 4000 FROM CLASSROOM 4030	LHR
1 SGL DOOR D4040A	MAIN LOBBY 4000 FROM CLASSROOM 4040	LHR
1 SGL DOOR D4050A	MAIN LOBBY 4000 TO CLASSROOM 4050	RH
1 SGL DOOR D4060	MAIN LOBBY 4000 TO MBA/MACC OFFICE 4060	LH

950 X 2440 X TRANSOM X 45	WD/HMF	
TYPE N	0 MIN	90 DEG

32ea	HINGES	FBB168 127 X 101 X NRP	626	ST
8ea	LOCKSET	ML2055 L/C X LWA	626	CO
8ea	CYLINDER	MEDECO - SUPPLIED BY OWNER	626	ME
8ea	ELECTRIC STRIKE	1006KM X 12/24VDC	630	HE
* PREP ONLY FOR FUTURE USE.				
8ea	FILLER PLATE	AF260 X MST PREP X 42.8mm RETURN	630	DJ
6ea	CLOSER	4040XP PA-EDA X TBGN	689	LC
* CLOSER TO BE SET TO SIZE 3.				
6ea	TRANSOM ADAPTER	419	689	LC
2ea	CLOSER	4040XP REG X TBGN (D4050A & D4060)	689	LC
* CLOSER TO BE SET TO SIZE 3.				
8ea	WALL STOP	S122	626	SM
8ea	KICK PLATE	K10A 203 X 912 X SMOH	630	SM
8 set	SMOKE SEAL	W-20S X 1@950/2@3000	628	KN
8ea	SMOKE SEAL	W-21S X 950	BLK	KN
* INSTALL AT RABBET OF TRANSOM PANEL				
8ea	DOOR BOTTOM	CT-50 X 950	628	KN
8ea	DOOR CONTACT	947	WHT	HW
* PREP ONLY FOR FUTURE USE. INSTALL CONTACT AS FILLER UNTIL REQUIRED.				
8ea	CARD READER	SUPPLIED BY OWNER FOR FUTURE USE		
24ea	SILENCERS	SUPPLIED BY FRAME MANUFACTURER		
1 set	ELEVATION / POINT TO POINT DRAWINGS			

NOTES:

* DOOR AND FRAME TO BE PREPPED FOR ELECTRIFIED HARDWARE LISTED ABOVE FOR FUTURE USE.

* PROVIDE CONDUIT IN DOOR AND FRAME FOR FUTURE ACCESS CONTROL.

Division 08 - Openings

HW SET #23

1 SGL DOOR D4010A	CLASSROOM 4010 FROM MAIN LOBBY 4000	RHR
950 X 2150 X 45	HMD/HMF	
TYPE I	45 MIN	90 DEG

4ea	HINGES	FBB168 127 X 101 X NRP	626	ST
1ea	EXIT DEVICE	98L-F x 996L-03 X 950	626	VD
1ea	CYLINDER	MEDECO - SUPPLIED BY OWNER	626	ME
1ea	ELECTRIC STRIKE	9500 X 12/24VDC	630	HE
1ea	AUTOMATIC OPERATOR	9540 X LESS ON/OFF SWITCH	689	LC
2ea	PUSH PLATE SWITCH	CM-7536/4	630	CM
1ea	KEY SWITCH	CM-1190-7212 (TO CONTROL EXT. PUSH PLATE)	630	CM
1ea	WALL STOP	S122	626	SM
1ea	KICK PLATE	K10A 203 X 912 X SMOH	630	SM
1 set	SMOKE SEAL	W-20S X 1@950/2@2150	628	KN
3ea	SILENCERS	SUPPLIED BY FRAME MANUFACTURER		
1ea	DOOR CONTACT	947	WHT	HW

* PREP ONLY FOR FUTURE USE. INSTALL CONTACT AS FILLER UNTIL REQUIRED.

1ea CARD READER SUPPLIED BY OWNER FOR FUTURE USE

1 set ELEVATION / POINT TO POINT DRAWINGS

NOTES:

* DOOR AND FRAME TO BE PREPPED FOR ELECTRIFIED HARDWARE LISTED ABOVE FOR FUTURE USE.

* PROVIDE CONDUIT IN DOOR AND FRAME FOR FUTURE ACCESS CONTROL USE.

DESCRIPTION OF OPERATION:

* DOOR IS NORMALLY CLOSED AND LOCKED.

* WHEN KEY SWITCH IS IN THE UNLOCKED POSITION THE PUSH PLATE SWITCH WILL CAUSE THE AUTOMATIC OPERATOR TO OPEN THE DOOR.

* ACTIVATION OF FIRE ALARM PREVENTS THE AUTOMATIC OPERATOR FROM CYCLING.

* FREE EGRESS AT ALL TIMES BY PUSHING ON THE EXIT DEVICE.

Disclaimer Statement

This specification guideline is intended to be used by a qualified construction specifier. The guide specification is not intended to be verbatim as project specification without appropriate modifications for the specific use intended. The specification guideline must be used and coordinated with the procedures of each design firm, coordinate with Carleton Facilities Management and the requirements of a specific construction project.

End of Section

08 50 00 – Windows

The purpose of this design guideline is to establish fundamental requirements for the specification, manufacturer, and installation of windows. The selection of window sizes, frames, and glass for specific applications establish a variety of criteria that include fire and life safety codes, building codes, barrier free accessibility and security.

All window frames are to be thermally broken. Set head, jamb, and sash members into recessed openings for positive weather break. Do not detail flush frames. Design and detail window openings and head, jamb, and sill conditions with air and vapour seal requirements described in *Division 07*.

- .1 Specify testing criteria for air infiltration and exfiltration, water penetration under static and dynamic air pressure, thermal cycling, and condensation resistance. Identify tolerances and criteria for acceptance by FMP or consultant.
- .2 Provide screens and below-screen frame operators for operating sash.

Disclaimer Statement

This specification guideline is intended to be used by a qualified construction specifier. The guide specification is not intended to be verbatim as project specification without appropriate modifications for the specific use intended. The specification guideline must be used and coordinated with the procedures of each design firm, coordinate with Carleton Facilities Management and the requirements of a specific construction project.

End of Section

08 60 00 – Wood and Plastic Windows

The purpose of this design guideline is to establish fundamental requirements for the specification, manufacturer, and installation of windows. The selection of window sizes, frames, and glass for specific applications establish a variety of criteria that include fire and life safety codes, building codes, barrier free accessibility and security.

- .1 Wood or plastic windows are not permitted.

Disclaimer Statement

This specification guideline is intended to be used by a qualified construction specifier. The guide specification is not intended to be verbatim as project specification without appropriate modifications for the specific use intended. The specification guideline must be used and coordinated with the procedures of each design firm, coordinate with Carleton Facilities Management and the requirements of a specific construction project.

End of Section

08 80 00 – Glazing

The purpose of this design guideline is to establish fundamental requirements for the specification, manufacturer, and installation of glazing. The selection of glazing for specific applications establish a variety of criteria that include fire and life safety codes, building codes, barrier free accessibility and security.

- .1 Hermetically Sealed Glass Units:
 - a. For windows, glazed frames curtain walls, doors, etc. minimum 1 inch (25mm) total thickness with metal protective edging. Warranted for ten (10) years after Substantial Completion for inter-pane dusting or misting.
- .2 Washroom Mirrors:
 - a. Minimum size of 17-3/4 inches (450mm) wide x 23-5/8-inch (600mm) high x 1/4-inch (6mm) thickness. Stainless steel frame with welded and ground edges and corners. Tamper proof fasteners. Wall length mirrors are not permitted.

Disclaimer Statement

This specification guideline is intended to be used by a qualified construction specifier. The guide specification is not intended to be verbatim as project specification without appropriate modifications for the specific use intended. The specification guideline must be used and coordinated with the procedures of each design firm, coordinate with Carleton Facilities Management and the requirements of a specific construction project.

End of Section

08 90 00 – Glazed Curtain Walls

The purpose of this design guideline is to establish fundamental requirements for the specification, manufacturer, and installation of glazed curtain walls. The selection of glazed curtain wall sizes, frames, and glass for specific applications establish a variety of criteria that include fire and life safety codes, building codes, barrier free accessibility, security and electronic access control.

- .1 Select a proven glazed wall framing design that will accommodate expansion and contraction, wind and suction loads, and suitable to building environmental design criteria.
- .2 Specify testing criteria for air infiltration and exfiltration, water penetration under static and dynamic air pressure, thermal cycling, condensation resistance, and structural performance to at least 1.5 times the design loads. Identify tolerances and criteria for rejection.
- .3 Meets U-Factor, SHGC (Solar Heat Gain Coefficient) and fenestration area limits as per ASHRAE Standard 90.1 requirements. Fenestration must not exceed mandatory air leakage limits. For windows, sliding doors, swinging doors and certain skylights, the maximum air leakage rate is 0.2 cfm/ft², or 0.3 cfm/ft² if tested at 6.24 psf.

Disclaimer Statement

This specification guideline is intended to be used by a qualified construction specifier. The guide specification is not intended to be verbatim as project specification without appropriate modifications for the specific use intended. The specification guideline must be used and coordinated with the procedures of each design firm, coordinate with Carleton Facilities Management and the requirements of a specific construction project.

End of Section

Division 09 – Finishes

All new construction and renovation projects on Carleton University campuses are required to meet the Carleton University Facilities Design Guidelines. Including from the initial planning and design stages through to the various phases of construction and facilities maintenance and management. They are to mirror planning, design, construction, maintenance, and other facilities supporting University personnel. These documents are to be used as a guideline only on all Carleton University projects and are not to be used for bidding, permitting construction, or any other purpose. Any changes or substitutions must be approved by Carleton University Facilities Management and Planning (CUFMP) and must be submitted in writing. This document is the property of Carleton University. Any use of this document, in part or in whole, for purposes other than a Carleton University project cannot be done without written permission from the University.

Table of Contents

09 20 00 - Gypsum Board Assemblies.....	3
09 30 00 - Tiling.....	8
09 51 00 - Acoustical Ceilings.....	11
09 54 00 - Specialty Ceilings.....	14
09 60 00 - Flooring	15
09 61 00 - Surface Preparation	17
09 65 00 - Resilient Flooring.....	20
09 66 13 - Portland Cement Terrazzo Flooring	23
09 66 16 - Terrazzo Floor Tile.....	23
09 67 00 - Fluid-Applied Flooring.....	24
09 68 00 - Carpeting.....	27
09 72 00 - Wall Coverings	29
09 91 00 - Painting and Coatings	29

09 20 00 - Gypsum Board Assemblies

Description

- .1 Provide gypsum board wall, bulkhead and ceiling assemblies.
- .2 Coordinate with insulation, sealants, wall tile and suspended acoustic ceilings.
- .3 Drywall board shall be guaranteed from defect, including fissures, cracking, surface deterioration or other defects of appearance or for a period of 3 years for labour and material.

Quality Assurance

Conform to the requirements of:

- .1 CSA A82.21-M, Gypsum and Terms Relating to Gypsum Products
- .2 CSA A82.27-M, Gypsum Board Products
- .3 CSA A82.31-M, Gypsum Board Application
- .4 ASTM C645-88, Specification for Non-load Bearing Steel Studs, Runners, and Rigid Furring Channels for Screw Application of Gypsum Board
- .5 ASTM E336, Method for Measurement of Airborne Sound Insulation in Buildings
- .6 ASTM E413, Classification for Rating Sound Insulation

Design Criteria and Notes

Structural Criteria:

- .1 Partitions in laboratory areas should be designed to carry a load of 195kg/m² (40 lb/ft²) - or as prescribed loads, uniformly distributed, for wall mounted cabinets and shelves.
- .2 Cavity shaft-wall systems to withstand a min. positive and negative pressure of 10psf.
- .3 Partitions in office or similar areas shall be designed to support shelves or any other wall mount indicated loads.
- .4 Provide adequate stiffeners, furring channels and/or plates, and sheet reinforcing secured between studs for installation of:
 - A/V, chalkboards, monitors, screens, and/or similar feature
 - M&E features and/or fixtures
 - Handrails
 - Shelving and cabinets
 - Any other similar.
- .5 No wood blocking is permitted within the following locations:
 - Laboratory spaces
 - Animal care facilities
 - High moisture spaces
- .6 Carry out additional regular steel stud, structural steel stud or miscellaneous steel reinforcement for vertical posts and lintels, as necessary in the following applications:
 - For all openings wider than 1800mm.
 - All free-standing partitions.
- .7 Use a min. 20 ga thick steel stud to support the following:

- Board material finished with ceramic, porcelain or thin brick cladding.
 - Fibre reinforced or high impact gypsum board or similar.
- .8 Double the studs at each side of door openings and all openings 915 mm (3'-0") or wider.
- .9 On the perimeter of all board ceilings, install continuous galvanized "L" shape frame 50mm x necessary height x ± 16 gauge.
- .10 Resistance to seismic forces shall be as required by codes in retrofit or new installation projects.

Notes:

- .1 Install 250 mm (10") long joint tape at 45o, perpendicular to the diagonals, at all corners of openings (doors, windows, inserted items of more than 100 mm x 100 mm (4"x 4") and at all changes of width or depth and take all other measures necessary to avoid cracking.
- .2 Install control joint as by best recommended practices, and at:
1. Maximum 9 m (30'-0") apart on walls horizontally and vertically, and 5 m (16'-0") apart on walls to receive ceramic, porcelain or thin brick cladding.
 2. Maximum 9 m (30'-0") apart on ceilings without perimeter relief, in both directions.
 3. Maximum 1.5 m (50'-0") apart in ceilings with perimeter relief, in both directions.
 4. Maximum 5 m (16'-0") apart on walls to receive ceramic, porcelain or thin brick cladding.
- .3 Install insulating strip for drywall, self-adhesive under floor track and above top track.

Products:

- .1 Pursue the use of sustainable materials with high recycled content.
- .2 Commence this work only after air temperature has been maintained at 13°C to 21°C for at least 24 hours before and can be maintained at same until joint cement and adhesives are fully cured, with proper ventilation to provide dry condition.
- .3 Straight, vertical, flat and true to building lines to within 3 mm in 3 m.
- .4 Suspended gypsum board assemblies to be level to within 8 mm in 3 m.
- .5 Partitions to offices, meeting rooms and washrooms to achieve minimum STC 45; higher if sensitive use.
- .6 Partitions to extend to underside of floor/roof above.
- .7 Partitions in areas of student occupancy are preferred to be concrete block for durability. Use of gypsum board assemblies will be considered; approval by the University Project Manager is required.

Gypsum Board:

- .1 Conforming to CSA A82.27-M
- .2 Minimum 90% recycled content

- .3 1.2 m wide by longest lengths suitable for elevator capacity
- .4 Thickness:
 - 12 mm, for ceilings
 - 12 mm, exterior grade
 - 16 mm, for walls
 - 16 mm Type X ULC listed, for fire rated assemblies.
 - Leave minimum 10 mm gap between top of board and structure above to accommodate deflection of structure.
- .5 Regular or fire-resistant gypsum board - Ends square cut, edges tapered. Suggested (or equivalent) products:
 - "Sheetrock" and "Sheetrock Firecode", regular, type X or type C, by CGC Inc.
 - "ToughRock" and "ToughRock Fireguard", regular, type X or type C, by GeorgiaPacific Canada.
 - "Easy-Lite", regular, type X or type C, by CertainTeed Canada.
- .6 Abuse resistant gypsum board, regular or fire-resistant: Composed of a core and faces of a blend of gypsum and cellulose fibre, ends square cut, edges tapered. Suggested (or equivalent) product:
 - "Fiberock Abuse Resistant" by CGC Inc.
 - "Extreme Abuse" by CertainTeed Canada.
- .7 High impact resistant gypsum board, regular and fire-resistant: Composed of a core of a blend of gypsum and cellulose fibre, with embedded glass fibre mesh scrim at the back, ends square cut, edges tapered. Suggested (or equivalent) product:
 - "Fiberock VHI" by CGC Inc.
 - "Extreme Impact" by CertainTeed Canada.
- .8 Acoustical gypsum board, regular and fire-resistant: Sound damping gypsum panel without paper or metal in the core, with tapered edges, cuts and installs similar to regular gypsum panel products. Suggested (or equivalent) products:
 - "QuietRock ES" by QuietRock Inc.
 - "SilentFX QuickCut" by CertainTeed Canada.

Moisture Resistant Gypsum:

- .1 Conforming to ASTM C 1178
- .2 Thickness: 12 mm minimum
- .3 For use in washrooms and changerooms.
- .4 Mould and moisture resistant gypsum board, regular or fire-resistant - Composed of a blend of gypsum and cellulose fibre, ends square cut, edges tapered. Suggested (or equivalent) products:
 - "Fiberock AquaTough", regular, type X or type C, Interior panels by CGC Inc.
 - "M2Tech", regular, type X or type C, by CertainTeed.
 - "Dens Armor Plus", regular, type X or type C, by Georgia Pacific.

- .5 Glass mat water resistant gypsum board, regular or fire-resistant - Composed of a blend of gypsum inorganic fiberglass mat surfacing on both sides, ends and edges square cut. Suggested (or equivalent) products:

- .1 "Dens-Shield" and "Dens-Shield Fire-Guard", regular, type X or type C, by Georgia-Pacific.
- .2 DiamondBack Glasroc", regular, type X or type C, by CertainTeed.

Cement Board:

- .1 Thickness: 16 mm.
- .2 For use at showers.

Sheathing:

- .1 Conforming to Gypsum to ASTM C 1177 and ASTM E 136.
- .2 Thickness: 12 mm exterior grade and 16 mm Type X.
- .3 Joint Tape: 50 mm wide 10x10 glass mesh.

Non-Loadbearing Steel Studs:

- .1 Minimum 0.53 mm core, Z275 galvanized, with min. 31.8 mm knurled faces and minimum 6 mm return, knock-outs in web for horizontal services and bracing, increase core thickness for heights over 2,400 mm to manufacturer's recommendation.
- .2 400 mm maximum spacing and at every 400 mm center across any wall surface.
- .3 Provide double studs each side of all openings and infill studs above and below openings.
- .4 Provide double studs at head and sill of all openings under 1,200 mm wide.
- .5 Provide reinforced box stud assemblies at all openings over 1,200 mm wide.
- .6 Brace with secured cross-bridging at every 1,200 mm vertically all walls that exceed 2,700 mm.
- .7 Brace as above walls between 2,400 mm high and 2,700 mm high with one row of cross-bracing at mid-height.

Steel Stud Systems:

- .1 Steel Stud System, Regular, Galvanized: Channel stud framing in "U", "ST": Roll formed from cold-formed galvanized steel sheets, of min. 0.455 mm (0.0179") (26 ga.) base metal thickness or more, as necessary; hot-dipped galvanized, for screw attachment of gypsum boards, with Top and bottom channel tracks in widths to suit stud sizes. Suggested (or equivalent) product: As manufactured by CGC Inc.
- .2 Interior Structural Steel Stud and Open-Web Heavy Duty Joist System, Galvanized: Channel Stud Framing and Joists: as per ASTM A653/A653M, studs of 152 mm (6") or 92 mm (3 $\frac{5}{8}$ ") depth. - Suggested (or equivalent) product: As manufactured by Baily Inc.

Accessories

- .1 Insulating strip for drywall, self-adhesive: Rubberized, moisture resistant 3 mm (1/8") thick closed cell neoprene composition strip, 19 mm (3/4") wide, with self-sticking permanent adhesive on one face. Suggested (or equivalent) products: "Permastik 1220" by Jacobs and Thompson Inc. (RCR International Inc.).
- .2 Deflection joint trim for walls: Pre-assembled joint trim composed of two 76 mm (3") wide, 0.66 mm (24 ga) thick galvanized metal strips joined by a 150 mm (6") wide, 1320 g/m² (39 oz/yd²) glass fibre fabric coated with neoprene. Suggested (or equivalent) products: "Super Metal-Fab", by Duro Dyne Canada Inc.
- .3 Steel deck flute closures in galvanized steel: In cold formed galvanized steel, at least 0.76 mm (22 ga) thick, with galvanized finish. Suggested (or equivalent) products: As manufactured by Canam Inc.

Neoprene Sheet:

- Dense, solid neoprene, 6 mm thick by full width of stud track.

Access Doors:

- Provide where required. Ensure they are of adequate size and placement to fully service equipment located above gypsum board installations.

Control Joints:

Made of zinc sheet, 44 mm x 13 mm (13/4" x 1/2"). Suggested (or equivalent) products: "Zinc # 093" by CGC Inc.

- .1 Provide double furring members or studs at control joints:
 - .1 Where gypsum board is installed over masonry control joints,
 - .2 Abutting structural elements,
 - .3 Dissimilar walls and ceilings,
 - .4 Changes in substrate construction,
 - .5 Approximate 10 m spacing on long partition runs,
 - .6 Approximate 15 m spacing on large ceilings, and
 - .7 Changes in superficial area.
- .2 Metal trim L-mouldings shall be required for junctions at windows and door jambs.
- .3 Seal all junctions between gypsum wallboard and adjacent surfaces.

End of Section

09 30 00 - Tiling

Description

- .1 Provide tile and prepare sub-floor.
- .2 Coordinate with Concrete slabs, Masonry, Gypsum Board and Mechanical floor drains.

Quality Assurance: Conform to the requirements of:

- .1 ANSI A108.1, Specification for the Installation of Ceramic Tile
- .2 CAN/CGSB-75.1, Tile, Ceramic
- .3 Terrazzo, Tile and Marble Association of Canada (TTMAC), Tile Specification Guide 09300, Tile Installation Manual
- .4 Tile to have passed ASTM C627, cycles 1 through 12 testing, heavy foot traffic load bearing performance.
- .5 Applicator to be a member company in good standing of the TTMAC with a minimum of five (5) years of successful work in projects of comparable or larger size.

Warranty

- .1 Provide (ten) 10 year labour and material warranty on mortars, waterproofing, bond coat, adhesive, grout and sealers.
- .2 All special flooring shall be guaranteed against all defects including cracking, crazing, surface deterioration or any other defects detrimental to the appearance or strength of the finishes, for a period of 3 years for labour and materials.
- .3 Manufacturer representative shall be present at all construction phases to ensure adequate quality control on the installation.

Design Criteria and Notes

- .1 Maintain air temperature and structural base temperature at installation area above 12°C for 72 hours before, during and 72 hours after installation.
- .2 Install tile in accordance with recommendations of Terrazzo Tile & Marble Association of Canada (TTMAC) and manufacturers' instructions.
- .3 Do not bridge saw-cuts or control-joints. Install backer rod and apply sealant or mouldings.
- .4 Terminate tiles at adjacent dissimilar finishes with transition or finishing trims at unprotected edges.

Products

- .1 Pursue the use of materials with recycled content.
- .2 Execute work while temperature is maintained between 10°C and 22°C for period of 72 hours before commencement, during and following installation. Avoid concentrated or irregular heating during curing period.
- .3 Concrete must be cured for a minimum of 28 days.

- .4 Protect work against damage by other trades for minimum 72 hours after application of grouting by prohibiting passage of traffic over tile. Cover completed floors with non-staining construction paper until other construction in tiled areas is complete. Do not immerse in water and protect tile work from freezing for at least 28 days after installation.
- .5 Obtain each specified material from one source with resources to provide products from the same production run for each contiguous area consistent in quality, appearance and physical properties.
- .6 Maintain adequate ventilation during installation.
- .7 Provide 3% extra stock of ceramic tile and trim in colours, patterns and sizes furnished to the University. Wrap in original protective containers, permanently labeled as to exact contents. Date and label with building and room numbers where used.
- .8 Provide all special shapes and finished tiles such as caps, inside and outside corners, solid trim pieces, bullnose, coved base, safety treads and catalogued accessories as required for complete work in conformance to applicable codes.

Tiles:

- .1 Porcelain Tiles: Tiles for floors and walls, single-fired, 8mm (0.32") thick, square edges, slip resistant surface (matte) or polished, through body, colored base, colored body or double pressed tile. Thin set application.
- .2 Unglazed Ceramic (Quarry) Tile: Tiles mainly for floors, unglazed, single fired, usual thickness from 8mm to 12mm, square edges, slip resistant matte finish, uniform texture and colored all the way through. Thin set application.
- .3 Glazed Ceramic Tile: Wall application only, vitreous natural clay or semi-vitrified glazed, 6 to 10mm thick, square edges, glossy surface and uniform texture. Multipurpose adhesive. Tiles larger than 4"x16" require thin set method.

Wall Tile:

- .1 Glazed porcelain, Class MR 1 in accordance with requirements of CAN/CGSB-75.1-M88, square edged.
- .2 Ensure coefficient of friction is suitable for intended application.

Floor Tile:

- .1 Unglazed porcelain, Class MR 1 in accordance with requirements of CAN/CGSB-75.1-M88, square edged.
- .2 Application: Corridors and washrooms.
- .3 Minimum size shall be 300 mm x 600 mm (1'-0" x 2'-0") unless noted by the Consultant as not feasible/increased risk (e.g. existing floor slab). University Project Manager to approve in Schematic Design.
- .4 Ensure adequate slope to drain in showers/wet areas. Smaller tile size is preferred in these areas.

Grout:

Epoxy, low VOC. Water cleanable, chemical resistant, stain resistant, factory blended. To be finished flush/level with surface of tile.

- Grout for floor tiles: Pre-mixed urethane based sanded that is stain resistant, single-part product, pigment free, color uniformity, low shrinkage and high crack resistance; colors to be selected by Consultants. Suggested (or equivalent) product: "Colour Max Plus" by Flextile Ltd.
- Grout for wall tiles: Portland cement base, polymer additives with high adherence and resistance, mildew resistant, for mixing with water; colours to be selected by Consultants. Suggested (or equivalent) product: "Flextile 500 Series" by Flextile Ltd.

Primer:

- Low VOC. As recommended by tile manufacturer.

Sealer:

- Low VOC. As recommended by tile manufacturer to CAN/CGSB 25.20.

Wet spaces:

- .1 Preferred: tiling of entire wall surface.
- .2 Acceptable (constrained budget): partial tiling, extended as follows:
 - Horizontally min. 200mm past the edge of showers and tubs.
 - Vertically to min. height of 1800mm in washrooms and 2000mm at showers/tubs.

Waterproofing Membrane: Showers and pool deck and walls.

- .1 Concrete board or waterproof drywall will not be accepted as a waterproofing material.
- .2 Use a waterproofing membrane system from a single manufacturer that includes drain, shower pan/floor components and wall components.
- .3 Concrete board or waterproof drywall is an acceptable substrate but must have the waterproof membrane system applied overtop.
- .4 Waterproofing system connection details shall create a continuous waterproof barrier and direct all water to drain.
- .5 Completely remove oil, grease, loose mortar, dust and all contaminants from areas scheduled to receive tile.
- .6 Except where tiles have setting tabs, and except for expansion, control and isolation joints, maintain 3 mm joints for ceramic tile.
- .7 When appropriate mix tiles from several boxes prior to installation to assure that colour variations from tile to tile are evenly distributed throughout the field.
- .8 Extend tiles behind mirrors, cabinets, cupboards and other fixed objects at walls.
- .9 Provide trim at all exposed edges.
- .10 Provide thresholds and transitions.
- .11 Verify that joints and cracks in tile substrates are coordinated with tile joint locations; adjust joints in consultation with Consultant where joints are not coordinated.

End of Section

09 51 00 - Acoustical Ceilings

Design Criteria and Notes

- .1 Acoustic Ceiling System to be ASTM 635 Light Duty Standard, installed in accordance with ASTM 636.
- .2 CANULC-S102, Surface Burning Characteristics of Building materials and Assemblies.
- .3 Pursue the use of sustainable materials with high recycled content.
- .4 Ensure product is stored in an area away from sources of dust and moisture. Store off the floor.
- .5 Supply a minimum of 2% of gross ceiling area of each type and pattern of acoustic tile. Date and label wrapping with building, floor and applicable room numbers.
- .6 Design for adequate support of electrical fixtures as required by Electrical safety Authority.
- .7 All services must be supported independently from the ceiling system, except of grid, panel or tile, light fixtures, and air terminals.
- .8 Maximum deflection for completed ceiling to be L/360 of span.
- .9 Resistances to seismic forces shall be as required by codes in retrofit or new installation projects.
- .10 Wet Labs - When acoustic tiles are used in wet lab applications materials shall confirm with the Canadian Biosafety Standard Level 2 environment requirements. Specifically, materials shall be cleanable and non-absorbent.
- .11 Provide self-adhesive color-coded dots 6mm in diameter to delineate ceiling access for plumbing, electrical, HVAC controls etc.
- .12 Touch up paint to be low VOC.
- .13 Unless noted on drawings, center ceiling system on room axis leaving equal border tiles or panels not less than 1/2 a full width.
- .14 Recessed items shall be centered on acoustical panels, except where indicated otherwise.
- .15 Acoustical ceiling panels shall not be installed until the building is enclosed and the environment is controlled.

Acoustic Tile

- .1 Mineral fibre panel, medium texture white.
- .2 Noise Reduction Coefficient (NRC) designation of 0.70 typical (0.55 minimum).
- .3 Ceiling Attenuation Class (CAC rating 0 (35 minimum).
- .4 Light Reflectance (LR) of minimum 0.84.
- .5 Flame Spread Rating: 25 or less.
- .6 Smoke Developed: 50 or less.
- .7 No Formaldehyde products will be accepted.

Products

Acoustical Tiles:

- .1 Mineral Fibre Acoustical Tiles, Regular: made of acoustically efficient non-combustible wet-formed mineral fibre, with square edge, latex paint face, white colour. - Suggested (or equivalent) product:
 - "Radar Clima Plus" by USC/CGC Inc.
- .2 Mineral Fibre Acoustical Tiles, Fire-Rated: made of acoustically efficient non-combustible wet-formed mineral fibre, with square edge, UL approved. Suggested (or equivalent) product:
 - "Radar Clima Plus Firecode" by USC/CGC Inc
 - "Performa Baroque", by CertainTeed.
- .3 Mineral Fibre Acoustical Tiles, Ornamental: made of acoustically efficient non-combustible wet-formed mineral fibre, with tegular edge, latex paint face, white colour. Suggested (or equivalent) products:
 - "Cortega Second Look II" by Armstrong.
 - "Radar Illusion Two/24" by CGC Inc.
 - "Performa Baroque", by CertainTeed.
- .4 Mineral Fibre Acoustical Tiles, with Vinyl Soil-Resistant Film: made of acoustically efficient noncombustible wet-formed mineral fibre, with soil-resistant finish, with square, sealed, coated edge when cut, vinyl film face, adhered to entire surface, white colour. Suggested (or equivalent) products:
 - "Clean Room VL & VL", by Armstrong.
 - "Clean Room Class 100", by CGC Inc.
 - "Vinylshield A,C", by CertainTeed.

Suspension System:

- .1 Cooperate with mechanical, electrical and other trades to accommodate fixtures, fittings and other items in acoustic ceilings.
- .2 Provide adequate access to utilities above suspended ceilings. Ventilate ceiling spaces as required.
- .3 Metal T-bar suspension systems and acoustic tile units:
 - Construction: Commercial quality cold rolled steel.
 - Main Tees: 25 mm (1") exposed face. Nominal 3600 mm (12'-0") long, rectangular bulb at top of web, 38 mm (1/2") high web, 9 mm (1/4") face width designed to lock into consecutive lengths to function structurally as a single unit with face at joint perfectly aligned and presenting a tight inconspicuous seam.
 - Cross Tees: 1" exposed face. 610 mm (2'-0") long, same design as main tee except designed to connect at main tee to form positive lock without play, loss or gain in grid dimensions with offset over-ride of face over main tee face flange to provide flush tee faces at joints.
 - Edge Moulding: Min. of 0.46 mm thick steel, 14 mm wide legs, capable of supporting all superimposed loads.
 - Trim: Extruded aluminum at suspended panels/clouds, minimum 6".

- Fixture Clips: As recommended by acoustic tile manufacturer.
 - Finish: All metal products shall be steel galvanized to Z275. All exposed surfaces shall first receive a pre-paint treatment, CGSB 31-GP-116M, and then a baked-on factory finish with satin sheen enamel in colour to match acoustic tile. Preference is white.
 - Typical spacing: 610x1220 mm grid with 24 mm (15/16") reveal. Preference to match existing ceiling grid spacing on floor if in existing building or space. New builds to meet standard metric units.
 - Custom: Only areas designed for enhanced architectural appeal, 610x610 mm grid; regular or square lay-in; white, or other system to suit application.
 - Duty: Intermediate for typical ceiling tile (mineral fibre). Heavy duty for wood or GWB panels.
- .4 Suspension System, Standard, for Acoustical Ceilings, Regular: Intermediate duty system, nonfire-rated, commercial quality, corrosion resistant. Components die cut. Tee with double web, rectangular bulb and 24 mm (15/16") rolled cap on exposed face. Suggested (or equivalent) products:
- "Prelude XL", by Armstrong.
 - "DX", by CGC Inc.
 - "15/16 Classic Stab System", by CertainTeed.
- .5 Suspension System, Narrow Faced, for Acoustical Ceilings, Regular: Similar to Standard Suspension system, but with 14.3 mm (9/16") face. Suggested (or equivalent) products:
- "Suprafine XL", by Armstrong.
 - "Centricitee DXT", by CGC Inc.
 - "9/16 Elite Narrow Stab System", by CertainTeed.
- .6 Suspension System, Standard, for Acoustical Ceilings, Fire-Rated: Intermediate duty system, commercial quality, corrosion resistant. Components die cut. Tee with double web, rectangular bulb and 24 mm (15/16") rolled cap on exposed face, UL approved. Suggested (or equivalent) products:
- "DX/DXL", by CGC Inc.
 - "15/16 FireSecure Stab System", by CertainTeed.

End of Section

09 54 00 - Specialty Ceilings

- .1 Specify water resistant and washable ceiling surfaces in high humidity spaces (food preparation, showers, washrooms, etc.).
- .2 Provide mould resistant and anti-microbial treated products where suitable such as high moisture locations, food service areas, etc.
- .3 Linear metal or wood plank ceilings must be rated for commercial or institutional applications and be limited to accent areas in the overall design concept, pending approval of the University Project Manager.

End of Section

09 60 00 - Flooring

- .1 General Flooring Selection Considerations & Standards
 - Static dissipative flooring for IT rooms.
- .2 Carpet Tile (Refer to Section 09 68 00 Carpeting)
 - Classrooms
 - Lecture Halls
 - Seminar Rooms
 - Office Spaces
 - Housing – Corridors
 - Meeting and Conference Rooms
 - Library
- .3 Ceramic Tile (Refer to Section 09 30 00 Tiling)
 - Lobbies and Entryways (extend minimum 10m from entrances)
 - Washrooms, Change Rooms and Shower Rooms w/waterproof membranes (slip retardant)
 - Food Service Spaces – Cafeteria and Kitchens (slip retardant)
 - Corridors - areas directly under water bottle stations or water fountains – transition strips to be aluminum
- .4 Linoleum (Refer to Section 09 65 Resilient Flooring)
 - Corridors (dry areas only)
 - Computer Labs (dry areas only)
 - Classrooms (dry areas only)
 - Library (dry areas only)
- .5 Sheet Vinyl (Refer to Section 09 65 00 Resilient Flooring)
 - Washrooms, Change Rooms and Shower Rooms (small) w/flash coving (slip retardant)
 - Laboratories (dry, wet and/or chemical exposure) w/flash coving – consider all laboratories to be wet with chemical exposure (slip retardant)
 - Janitorial / Utility (wet and chemical exposure) w/flash coving (slip retardant)
 - Lounges (slip retardant)
 - Food Service Spaces – Cafeteria (slip retardant)
 - Corridors - areas directly under water bottle stations or water fountains – transition strips to be aluminum (slip retardant)
 - Ramps (slip retardant)
 - Heavy traffic areas (slip retardant)
- .6 Acoustic Vinyl Plank/Tile (Refer to Section 09 65 00 Resilient Flooring)
 - Computer Labs
 - Classrooms
 - Housing – Dorms, Corridors & Lounges
 - Lounges
 - Library
 - Corridors

- Office Spaces
- .7 Poured Epoxy
 - Commercial Kitchens
 - Washrooms, Showers and Change Rooms
 - Laboratories
- .8 Polished Concrete / Terrazzo
 - Lobbies and Entryways
 - Corridors
- .9 Hardened and Sealed Concrete
 - Mechanical, Electrical and Service Spaces
 - Janitorial / Utility
 - Engineering Laboratories, Testing Spaces
 - Equipment Rooms
 - Trades Shops
- .10 Walk-off Entry Mats
 - Institutional Grade
 - Extend min. 4m from entrances on slip-resistant surfaces and 6m on slippery floors.
 - Matting shall be installed on flush floor; mat wells (depressions) are not acceptable.
 - Acceptable products: min. 7.94mm thick; nylon polypropylene; vinyl backed, heavy edged and containing min. 30% recycled material:
 - 3M Nomad 8850, or approved equivalent.

End of Section

09 61 00 - Surface Preparation

Design Criteria and Notes

- .1 Prepare floor using grinding, Blastrac system, acid etching (as a last resort), or by other means, to remove all surface gloss and laitance and produce a level surface, as recommended by the manufacturer. Do not use sand shot blasting without facilities approval.
- .2 Scarify narrow cracks to 12.7 mm (1/2), then fill depressions and cracks, as well as holes, and other defects and crevices in the substrate with appropriate types of mortar.
- .3 Do not fill saw-cuts, expansion and construction joints with mortar or grout.
- .4 Remove all surface contamination by washing with an appropriate cleaner such as "TSP" (Trisodium Phosphate). Rinse thoroughly and allow drying. Do not use hydrocarbon solvents for cleaning. Existing peeled or checked paint should be scraped and sanded to a sound surface. Glossy surfaces should be sanded dull. Stains from water, smoke, ink, pencil, grease, etc. should be sealed with the appropriate primer/sealer.
- .5 For extreme conditions, prepare existing painted metal surfaces as per The Society for Protective Coatings (SSPC-SP1 & SSPC-SP6) solvent & commercial blast cleaning specifications, to remove existing or cracked paint, rust or other contaminants and render surface rough.

Products

.1 Flooring fillings:

- .1 Crack filler and repair mortar: Two-component multi-purpose, non-shrink, solvent-free and moisture- insensitive epoxy and binder.
 - Suggested (or equivalent) product: "Planibond EBA" by Mapei.
- .2 Patching compound, over existing finishes (up to 3mm): A fast-setting mix of Portland cement blended with inner fillers and synthetic dry polymer resins for conditioning concrete and patching and filling of minor cracks and depressions over properly prepared wood underlayments, vinyl or ceramic tiles.
 - Suggested (or equivalent) product: "Plani/Patch" with "Plani/Patch Plus" by Mapei.
- .3 Modified cementitious mortar for concrete repairs and slopes (for toppings of 1.5mm to 40mm): A self-levelling & tapered blend of portland cement and other hydraulic cements; for interior use only.
 - Suggested (or equivalent) product: "Ardex K13" by Ardex.
- .4 Modified cementitious mortar for concrete fill (for toppings of 10mm to 100mm): One component, shrinkage crack free, fast-setting and drying polymer-modified

cementitious mortar consisting of special hydraulic binders, selected aggregates, special additives and polymeric resin, for interior or exterior use.

- Suggested (or equivalent) product: "Mapecem 100" by Mapei.
- .5 Epoxy based grout for concrete repairs and slopes fast drying: A three-component, fast setting, trowelable, epoxy-based grout designed for permanent horizontal repairs to concrete foundations, decks, floors and structural surfaces, with high strength and excellent chemical resistance, for interior use.
- Suggested (or equivalent) product: "Stonset TG5" by Stonhard.
- .6 Levelling and repairing compound, high compressive: A high compressive strength cementitious, rapid hardening premixed self-levelling underlayment compound for levelling and repairing substrate up to 12 mm (½") in depth, with compressive strength attaining more than 29.5 MPa and linear shrinkage not more than 0.05% after 28 days cure.
- Suggested (or equivalent) product: "Ultra/Plan" by Mapei.
- .7 Modified cementitious mortar for concrete repair, high resistance, low permeable (for toppings of 6mm to 50mm): A preblended two-component, shrinkage crack free, fast-setting polymer-modified cementitious mortar consisting of high strength hydraulic binders, selected aggregates, and special additives; high wear resistant, for interior and exterior use.
- Suggested (or equivalent) product: "Mapecem 202" by Mapei.
- .8 Portland Cement Terrazzo: Underbed and topping, to comply with NTMA's (Terrazzo Specifications and Design Guide) for terrazzo system indicated for component proportions and mixing, with the following characteristics:
- Portland Cement: As per ASTM C 150, Type 1.
 - Water: Potable.
 - Sand: As per ASTM C 33/C 33M.
 - Aggregates: Contain no deleterious or foreign matter.
 - Abrasion and Impact Resistance: Less than 40 percent loss per ASTM C 131.
 - 24-Hour Absorption Rate: Less than 0.75 percent.
 - Dust Content: Less than 1.0 percent by weight.
 - Matrix Pigments: Pure mineral or synthetic pigments, alkali resistant, durable under exposure to sunlight, and compatible with terrazzo matrix.
 - Bonding Agent: Neat Portland Cement, or epoxy or acrylic bonding agents formulated for use with topping indicated.

- Underbed Reinforcement: Galvanized welded-wire reinforcement, wire 2 by 2 inches (51 by 51 mm) by 0.062 inch (1.57 mm) in diameter, complying with ASTM A 185/A 185M and ASTM A 82/A 82M, except for minimum wire size.
- Isolation Membrane (if necessary): Polyethylene sheeting, ASTM D 2103, Type 13300, 4 mils (0.1 mm) thick; or unperforated asphalt felt, ASTM D 226, Type I (No. 15).
- Mix Color and Pattern: To match existing.

Accessories

- .9 Underlayer Waterproof Membrane: For interior use, a Waterproof & Crack Isolation Membrane, for use below bond coat, under all ceramic tile and stone installation where a waterproof surface is required. Exceeds ANSI A118.10 and ANSI A118.12 standards.
- Suggested (or equivalent) product:
 - “WP-900”, with “WP980 fabric”, by Flextile Ltd.
 - “Kerdi” or “Kerdi-DS”, by Schluter Systems.

End of Section

09 65 00 - Resilient Flooring

Design Criteria and Notes

- .1 Maintain minimum 20°C air temperature at flooring installation area for 3 days before, during and for 48 hours after installation.
- .2 Install transition or finishing trims, or reduction strips where necessary at termination of flooring.
- .3 Hard nosing to be installed on the steps or tiers, with contrasting colours.
- .4 Seal and Waxing:
 - .1 No wax or other floor finish shall be applied on pre-protected linoleum surfaces and other non-waxed resilient products.
 - .2 Waxing procedures:
 - Decap / clean existing surface resilient finishes.
 - Application of sealer coat product, recommended by resilient finish manufacturer, followed by three coats of wax.
- .5 Supply a minimum of 2% of each type and colour of flooring. Date and label wrapping with building, level and applicable room numbers.
- .6 Test for moisture vapour transmission in accordance with ASTM F710-11 and ASTM F1869-11 or ASTM F2170-11 in accordance with manufacturer's written flooring installation instructions. Results must not exceed 170 µg/m² (3 pounds per 1,000 ft²) in 24 hours when tested to ASTM F1869-11, or exceed 75% when tested to ASTM F2170-11.
- .7 Ensure existing floor slab is smooth and level to within 1:1000.
- .8 Pursue the use of sustainable materials with high recycled content.
- .9 Extend finish under built-in cabinetry and fixed furnishings to wall.
- .10 Temperature of room, floor surface and materials maintained between 18°C and 21°C for 48 hours before, during and for 48 hours after installation.
- .11 Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.
- .12 Ensure that adequate ventilation is provided during installation and curing of materials.
- .13 Moisture Barrier: On new concrete floor slab on grade, moisture barrier is required. Follow flooring manufacturer's recommendation on product selection.
- .14 Adhesive/Primer: Low VOC, as recommended by flooring manufacturer.
- .15 Substrate Filler: Low VOC, as recommended by flooring manufacturer.
- .16 Seaming System: Heat welding rod system as manufactured by flooring manufacturer.
- .17 Thresholds and Binder Bars: Vinyl, screw-down type as recommended by flooring manufacturer, colours from manufacturer's complete range. FADS compliant.
- .18 Resilient Base: 100% rubber, 102 mm high x 30 m roll lengths x 3 mm thick with grooved back and standard toe.
- .19 Stairway Management: Integrated high contrast strip.
- .20 Lay flooring to produce a minimal number of seams.

- .21 Terminate flooring at centreline of door in openings where adjacent floor finish or colour is dissimilar.
- .22 At edge of dissimilar floor finishes, resilient and other flooring, other than carpet, provide one-piece thresholds and edge reducer strips.

Products

Resilient finishes:

- .1 Vinyl Composition Tiles (VCT) or Luxury Vinyl Tiles (LVT): Through pattern, asbestos-free, 3 mm (1/8") thick, precision cut, with colour and pattern extending through the full thickness of the tile, and chemical and abrasive resistance to suit.
- .2 Luxury Vinyl Planks: Through pattern, asbestos-free, 3 mm (1/8") thick, precision cut, with colour and pattern extending through the full thickness of the tile, and chemical and abrasive resistance to suit. Rough texture or deep grooves are not an acceptable finish.
- .3 Homogeneous Vinyl Sheet Flooring or tiles: Wax-free, homogeneous sheet vinyl flooring having nominal thickness of 2 mm (0.08"). Colour and pattern shall be dispersed uniformly throughout the thickness of the product; with a polyurethane coating, and chemical and abrasive resistance to suit.
- .4 Linoleum Sheet Flooring or Tile: Made of natural ingredients, consisting of oxidized linseed oil combined with resins, wood flour, inorganic filler material, chalk, natural pigments and cork, mixed and calendared to a jute backing having nominal thickness of 2 mm (0.08").
- .5 Flocked Flooring Tiles: Flocked high-performance carpet tiles with a 100% nylon type 6.6 wear layer with an intermediate fiberglass layer and a recycled closed cell vinyl cushioned backing.
 - Suggested (or equivalent) product: "Flotex modular Seagrass" series, as manufactured by Forbo.

Accessories:

Cork Underlayment: In rolls or sheets, made of natural Cork, 6mm or 12mm as necessary.

- Suggested (or equivalent) product: As manufactured by QEP.

Sound Reducing Underlayment: Dual Sheet, 10mm Thick free floating, dry leveling, sound reducing.

- Suggested (Or Equivalent) Products:
 - "Jumpax Waterprrof", By Impacta.
 - "Forbo NR 99", by Forbo.

Rubber Wall Base: Rubber wall base is standard unless flash coving, tile or epoxy flooring has been indicated. Rubber wall base to be 101.6 mm (4").

- Acceptable products or approved equivalent: Johnsonite Tightlock or Cove Base.

Stair Tread with Integrated Riser, in Rubber: Anti-skid, in homogeneous composition of 100% synthetic rubber, integral with wire reinforced contrasting nosing patterns. Stringers to be rubber and match colour of treads and riser. Landings to be rubber and match pattern and colour of treads and riser. Transitions to carpet tile, resilient vinyl, tile, concrete, terrazzo, linoleum or other flooring types with rubber stair landings and/or treads must provide a transition strip that deals with the variance in thicknesses on a case by case basis.

- Suggested (or equivalent) Product:
 - “Angle Fit” by Tarkett.
 - Johnsonite

Tactile Walking Surface Indicators, in Rubber: In homogeneous composition of 100% synthetic rubber, high quality additives – for interior applications only.

- Suggested (or equivalent) Product: “Tactile Walking Surface” by Tarkett.

Seams: Heated, welded, threaded in colour to match flooring. Material as recommended by the sheet flooring manufacturer.

Transition and Reducer Strips: Transitions between carpet tile and resilient or plank vinyl can be net fit where their height is equal and product lines match.

- Reducer strips: provide at all exposed edges of flooring materials. Where flooring terminates in a door opening, center reducer under door.
- Transition strip preference is aluminum with rubber and vinyl an acceptable alternate.

End of Section

09 66 13 - Portland Cement Terrazzo Flooring

- .1 Include sealers and densifiers.
- .2 When used in classrooms they need to be anti-fatigued matt.

End of Section

09 66 16 - Terrazzo Floor Tile

- Consult and reference TTMAC (Terrazzo, Tile, and Marble Association of Canada) manuals for terrazzo work. Specify terrazzo cleaning and preparation for maintenance to conform to TTMAC requirements prior to acceptance of the work by FMP.

End of Section

09 67 00 - Fluid-Applied Flooring

Description

- .1 Provide epoxy flooring, base and sub-floor preparation.
- .2 Coordinate with Concrete, Masonry and Gypsum Board.

Quality Assurance: Conform to the requirements of:

- .1 ASTM E 1907-97 - Standard Practices for Determining Moisture-Related Acceptability of Concrete Floors to Receive Moisture-Sensitive Finishes.
- .2 ASTM D 4263-83 - Indicating Moisture in Concrete by Plastic Sheet Method.
- .3 ASTM F 1869-98 - Measuring Moisture Vapour Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride.
- .4 ASTM D 4414-84 - Measurement of Wet Film Thickness by Notch Gages.
- .5 CSA A23.2-00 A23.2-6B Method of Test to Determine Adhesion by Tensile Load.
- .6 International Concrete Repair Institute (I.C.R.I.) Guideline Number 03732 – Selecting and Specifying Concrete Surface Preparation for Sealers, Coatings and Polymer Overlays
- .7 Applicator to have with minimum five (5) years experience in application of products, systems and assemblies specified and with approval and training of product manufacturer.
- .8 Determine if the surface texture of the concrete is comparable to I.C.R.I. Texture CSP 3-5.
- .9 Determine the tensile bond strength of the concrete before application begins in accordance with CSA A23.2-6B. Minimum acceptable test result is 1.5 MPa (210 psi).
- .10 Test for moisture vapour transmission in accordance with ASTM F710-11 and ASTM F1869-11 or ASTM F2170-11 in accordance with manufacturer's written flooring installation instructions. Results must not exceed 170 µg/m² (3 pounds per 1,000 ft²) in 24 hours when tested to ASTM F1869-11, or exceed 75% when tested to ASTM F2170-11.
- .11 Determine the surface moisture content by using an impedance moisture meter designed for use on concrete as detailed in ASTM E1907. Acceptable test results shall be 4% by mass or less.
- .12 Determine the Dew Point of the surface to be coated before application. The Contractor must monitor the Dew Point during application and initial cure. The surface must be at least 3°C (5.5°F) above the measured Dew Point at all times during application and cure.

Design Criteria and Notes

- .1 All special flooring shall be guaranteed against all defects including cracking, crazing, surface deterioration or any other defects detrimental to the appearance or strength of the finishes, for a period of 3 years for labour and materials.
- .2 Maintain surfaces and ambient air temperature between 13°C and 28°C for a minimum of 72 hours before, during and after application, and ambient relative humidity below 80% during application. Ensure moisture content in the substrate is within the limits prescribed by the manufacturer.

- .3 Do adherence test before beginning the work to ensure compatibility between new and existing floorings and coatings. Also, do a test of the cleaning process to ensure sufficient adhesion of new coating.
- .4 Separate with a clean cut existing and new surfaces.
- .5 Do not cover expansion joints. For flooring with considerable thickness, at saw cuts and construction joints, install a 150 mm (6") glass fiber reinforcing fabric tape (09 96 00), attaching with epoxy adhesive on both sides to the concrete slab surfaces, but leaving unadhered over the caulking. Only at construction joints install also "L" shaped divider strips, back to back, without attaching them together and ensuring that each one has at least 6 mm (1/4") adherence to the slab.
- .6 The concrete surface must be dry, clean and sound. Remove dust, laitance, grease, oil, dirt, curing agents, impregnations, wax, foreign matters, coatings and disintegrated materials from the surface by an appropriate mechanical means, i.e. steel shot blasting, sand blasting or any other method approved by the manufacturer. Surface texture I.C.R.I CSP 3-5.
- .7 Protect adjacent surfaces, fixtures and equipment with a drop cloth or adequately cover to prevent damage from splatter, spillage or any other damage resulting from work.
- .8 Fill all non-moving cracks, control joints, pockmarks, depressions or rough concrete with manufacturer's recommended product.
- .9 Key all edges that do not terminate at a wall or curb to avoid feathered edges. All through floor penetrations such as drains and trenches require a keyed edge that maintains a uniform 6 mm (1/4") thickness.
- .10 Temperature of room, floor surface and materials maintained between 18°C and 21°C for 48 hours before, during and for 48 hours after installation.
- .11 Supply a minimum of 2% of gross area of each type and pattern/colour of flooring.
- .12 Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.
- .13 Ensure that adequate ventilation is provided during installation and curing of materials.
- .14 During application check the wet film thickness of the materials in compliance with ASTM D 4414-84 test method 'Measurement of Wet Film Thickness by Notch Gages'.
- .15 Finished work must be uniform in thickness, sheen, colour, texture, and shall be slip resistant.
- .16 Provide adequate temporary protection from traffic, water and chemical exposure until flooring is fully cured.

Products

- .1 Clear Acrylic Floor Sealer: Acrylic resin-based polymer sealer-curing film. Minimum two coats, 50-75 microns (2-3 mils) of dry film per coat.
 - Suggested (or equivalent) product: "Sikafloor CureHard-24" by Sika (Duochem).
- .2 Pigmented Urethane Floor Coating: Two component glossy polyester resin and aliphatic polyurethane hardener coating, with an antiskid agent. Minimum two coats, 87.5 microns (3.5 mils) of dry film per coat.

- Suggested (or equivalent) product: "942" system by Sika (Duochem).
- .3 Pigmented Urethane Floor Coating, with Waterproof Membrane: Two components glossy polyester resin and aliphatic polyurethane hardener coating, with an antiskid agent and with polyurethane based elastomeric membrane. Minimum 1 mm (40 mils) of dry film, and 850 microns (34 mils) of membrane and 125 microns (5 mils) of finish coating.
 - Suggested (or equivalent) products: "SikaFloor 304W, by Sika (Duochem).
- .4 Epoxy Quartz Flooring System, Trowelled: Seamless, trowel applied epoxy quartz flooring, with a multi-colored ceramic granular aggregate, with antiskid finish and a clear urethane protective coat. Minimum 3 mm (1/8"), including primer coat, grout coat, and two epoxy finish coats of 125 microns (5 mils) dry film each. In addition, a protective urethane coat of 87.5 microns (3.5 mils) of dry film.
 - Suggested (or equivalent) products: "9200/902" system by Sika (Duochem).
- .5 High Performance Epoxy Pigmented Floor Coating, High Gloss: Two-component high performance epoxy floor coating, with antiskid agent. Minimum 50 microns (2 mils) of dry film thickness of the coating, and two coats, min. 200 microns (8 mils) of dry film per coat.
 - Suggested (or equivalent) products: As manufactured by Sika (Duochem):
 - "Duroplast 100", finish coat.
 - Silica sand grit 70, antiskid agent.
- .6 Epoxy Cove Base: 150 mm high radius with integral seal at floor-to-wall interface.
 - Applicable areas: wet areas and where chemical resistance is required.
 - Thickness: 3.0 mm.
 - Three-coat application consisting of a prime coat of 8 mils, a neat resin coat at 45 mils / broadcast to rejection with selected sand and a topcoat at 10-20 mils. Low VOC.

End of Section

09 68 00 - Carpeting

General

- .1 Carpet tile is the preferred carpet product used on campus. Broadloom is permissible under limited application such as lecture theatre steps and risers.
- .2 Provide carpet tile and base and sub-floor preparation.
- .3 Coordinate with Concrete, Masonry and Gypsum Board.

Quality Assurance: Conform to the requirements of:

- .1 CGSB 4-GP-129, Carpets, Commercial;
- .2 CGSB 4-GP-156, Direct Glue Down Carpet, Guide to Selection and Installation;
- .3 CGSB 20-GP-23M, Cashion Carpet, Flexible Polymeric Material.
- .4 CAN/ULC-S102.2-M88, Canadian Flammability Testing.
- .5 Subcontractor to be approved by the carpet manufacturer.
- .6 Determine if the surface texture of the concrete is comparable to I.C.R.I. Texture CSP 3-5.
- .7 Meet or exceed Carpet & Rug Institute Green Label Plus testing requirements.

Warranty

- .1 Warrant carpet for a total period of fifteen (15) years against wear, edge ravel, zippering, backing resiliency, static control and delamination including full product replacement in areas of wear to include the whole room when defined by 3 interior walls or visible area of open office. Warranty not to be pro-rated and to include product re-installation.
- .2 Warrant installation for a total period of two (2) years, including seaming and delamination.

Products

- .1 Pursue the use of sustainable materials with high recycled content.
- .2 Deliver and store where directed; 3% extra stock of carpet proportioned to colours and textures installed. Label with building, level and applicable room numbers.
- .3 Store in a heated area maintained at minimum temperature of 10°C or at such temperature as recommended by the product manufacturer.
- .4 Ensure that adequate ventilation is provided during installation and curing of materials.
- .5 Carpet Tile: Integral under-pad.
- .6 Adhesive System: Low VOC, water based as recommended by carpet manufacturer.
- .7 Seam Cement: Low VOC, water based as recommended by carpet manufacturer.
- .8 Provide edge adaptors/transition strip/thresholds as required. Position edges of carpet in door openings, under door, in its closed position.
- .9 Provide adequate temporary protection from traffic, water and chemical exposure until flooring is fully cured.
- .10 Certified for flammability to Health Canada Regulations under Hazardous Products (Carpet) Regulations, Part II of the Schedule.

- .11 Maximum flame spread rating 300, maximum smoke developed classification 500, when tested to CAN/ULC-S102.2.
- .12 Colours from manufacturers standard range.
- .13 Acceptable pattern: as approved by FMP.
- .14 Carpet tile dimensions: 500 mm x 500 mm.
- .15 Construction: tufted, tip-sheared.
- .16 Pile surface appearance: level-loop, textured.
- .17 Pile fibre: CAN/CGSB-4.129.
- .18 Nylon: staple type nylon 6.6.
- .19 Yarn ply: 2-ply.
- .20 Gauge: 47.2 ends / 100 mm.
- .21 Stitch rate: 38 ends / 100 mm.
- .22 Pile density: 5035.
- .23 Pile height: 5.3 mm.
- .24 Pile thickness: 3.6 mm.
- .25 Yarn dye method: 100% solution dyed.
- .26 Total weight: 610g/m³.
- .27 Colourization: multiple colour tones.
- .28 Colourfastness to light: CAN/CGSB-4 No. 18.3.
- .29 Recycled content: 66-74%.
- .30 Secondary backing: fiberglass reinforces.
- .31 Density as per ASTM D1667.
- .32 Adhesive: milled applied releasable dry adhesive.

Acceptable product manufacturers:

1. INTERFACEFLOR
2. TANDUS
3. SHAW
4. COLLINS AND AIKMAN

End of Section

09 72 00 - Wall Coverings

- Vinyl wall coverings and wallpaper are not acceptable. Decorative vinyl applications such as the “Carleton swoop” or accent graphic may be coordinated through FMP Signage.

End of Section

09 91 00 - Painting and Coatings

Description

- .1 Provide all labour, materials, tools and other equipment, services and supervision required to complete all exterior and interior painting and decorating work. Work also includes, but is not limited to, surface preparation of substrates as required for acceptance of painting, including cleaning, small crack repair, patching, caulking, making good surfaces and areas, pre-treatment, priming and back-priming.

Quality Assurance: Conform to the requirements of:

- .1 Architectural Painters Institute, Architectural Painting Specification Manual
- .2 ECP-07-89/ECP-12-89
 - Interior Latex Type, Flat Paint - CAN/CGSB-1.100-M (Ceilings ONLY)
 - Primer-Sealer, Wall, Interior Latex Type - CAN/CGSB-1.119-M
 - Paint, Exterior, Latex Type, Flat - CGSB 1-GP-138M
 - Emulsion Type Filler Masonry Block - CAN/CGSB-1.188-M
 - Interior Semigloss Latex Paint - CAN/CGSB-1.195-M
 - Primer, Exterior, Latex Type - CGSB 1-GP-203Ma
 - Stain, Pigmented, Exterior Latex Type - CGSB 1-GP-204M
- .3 Subcontractor to have a minimum of five (5) years proven satisfactory experience.
- .4 All paints and coatings to meet the applicable VOC limits of the South Coast Air Quality Management District (SCAQMD) Rule 1113 effective June 3, 2011.
- .5 Supply paint from a single manufacturer.

Design Criteria and Notes

- .2 The design of all paint and coating systems, surface preparation and maintenance shall be in accordance with the Master Painter’s Institute (MPI) – Architectural Painting Specification Manual (Latest Edition) for new surfaces, and the MPI Maintenance Repainting Manual (Latest Edition) for repainting and previously un-coated surfaces.
- .3 For projects that contain both new and existing surfaces, specify both new and existing systems as necessary (i.e. INT 9.2B (new) and RIN 9.2B).

- .4 For existing surfaces, DSD values shall be evaluated and specified by the Consultant. Alternately, specify minimum system requirements (including prep, priming, sealing, etc.) as described by the MPI standard.
- .5 All paint systems shall be MPI “premium grade”. Other materials such as linseed oil, shellac, thinners, solvents, etc. shall be the highest quality product of an MPI listed manufacturer.
- .6 All interior paints, primers and stains to be low VOC.
- .7 For existing surfaces where, existing oil based or alkyd-based finish is suspected prepare and prime with appropriate product to accept water based low VOC final product.
- .8 Do not paint stainless steel ducts.
- .9 Perform no painting or decorating work when the ambient air and substrate temperatures, relative humidity and dew point and substrate moisture content is below or above requirements for both interior and exterior work.
- .10 Apply paint only to dry, clean, properly cured and adequately prepared surfaces in areas where dust is no longer generated by construction activities such that airborne particles will not affect the quality of finished surfaces.
- .11 Ensure that adequate ventilation is provided during installation and curing of materials.
- .12 Schedule work to minimize absorption of fumes into surrounding porous materials.
- .13 Ensure containers are kept closed when not in use.
- .14 Paint, stain and wood preservative finishes and related materials (thinners, solvents, caulking, empty paint cans, cleaning rags, etc.) shall be regarded as hazardous products. Recycle and dispose of same subject to regulations of applicable authorities having jurisdiction.

Products

Water Based Paint Standard:

- Approved: Dulux Lifemaster and Dulux Diamond or approved equivalent.
- In accordance with Environmental Choice Program guideline ECP-07-89, water based paint shall be formulated or manufactured free from formaldehyde, halogenated solvents, aromatic hydrocarbons, mercury or mercury compounds, or be tinted with pigments of lead, cadmium, chromium VI and their oxides.
- Graffiti covering: On oil painted metal surface; properly sand surface, cover graffiti with a graffiti sealer such as “Kilz” or “Zinsser”, prime entire surface with oil to latex transition primer such as “ICI Gripper” then paint.
- Properly prepare any existing oil painted doors with heavy sanding and apply a proper transition primer such as “Gripper” as required, then use Latex semi-gloss as per manufacturers specifications and allow proper cure time.

Solvent Base Paint Standard:

- In accordance with ECP guideline ECP-12-89, solvent based paint shall not be formulated with formaldehyde, halogenated solvents, aromatic hydrocarbons in excess of 10% of weight, mercury or mercury compounds, or be tinted with pigments of lead, cadmium, chromium VI and their oxides.
- All paint shall be ready-mixed and pre-tinted.

Paint gloss in accordance with the following MPI values:

Gloss Level	Description	Units @ 60°	Units @ 85°
G1	Matte or Flat finish	0 to 5	10 max.
G2	Velvet finish	0 to 10	10 to 35
G3	Eggshell finish	10 to 25	10 to 35
G4	Satin finish	20 to 35	35 min.
G5	Semi-Gloss finish	35 to 70	
G6	Gloss finish	70 to 85	
G7	High-Gloss finish	> 85	

GENERAL APPLICATION ¹	LOCATION	PAINT TYPE				MPI CODE NUMBER									
		Latex 100% Acrylic H. Perf.	Latex 100% Acrylic	Light industrial Acrylic	Varnish & Lacquers	PRIMER ON SUBSTRATE					FINISH COAT SHEEN ²				Notes
						Concrete	Masonry	Gypsum wall board	Galvanized steel	Wood	Level 1 (Flat)	Level 3 (Eggshell)	Level 5 (Semi-gloss)	Level 6 (Gloss)	
Walls:															
General application	Interior		X			4	3	50				52			
Public, high traffic and average abuse spaces	Interior	X				4	3	50				139			
High abuse or High moisture & similar spaces	Interior			X		4	3	50					153		
Ceilings:															
General application	Interior		X			4		50			53				
High abuse or High moisture & similar spaces	Interior			X		4		50					153		
Door, window frames, Balustrades, handrails, decks, and all miscellaneous surfaces:															
General application – metallic surfaces	Interior	X							134				153		
	Exterior			X					134					164	
High abuse or High moisture & similar spaces – metallic surfaces	Interior			X					134				153		
General application – Wooden surfaces	Interior	X								6			141		
	Interior				X									56	
	Exterior	X								6				164	
Notes:															
.1 Refer to Finish Schedule for detailed information about finishes applications. Refer to other related Sections for Special coatings finishes.															
.2 MPI Sheen levels:															
<u>Level 1:</u> Gloss at 60 degrees – Max. 5 units; Sheen at 85 degrees – Max. 10 units.															
<u>Level 3:</u> Gloss at 60 degrees – 10-25 units; Sheen at 85 degrees – 10-35 units.															
<u>Level 5:</u> Gloss at 60 degrees – 35-70 units.															
<u>Level 6:</u> Gloss at 60 degrees – 70-85 units.															
<u>Note:</u> Subject to Facility approvals, Sheen levels could be maintained as existing adjacent in case of limited renovation projects.															
.3 In general, for new surfaces, to apply 1 primer coating & 2 finish coats. Primer coating could be skipped for existing painted surfaces.															

Finishes

Exterior Steel Coatings:

- Typical finishes for exposed (outdoor) metal fabrications:
 - Hot-dip galvanized.
 - Stainless steel.
 - Clear anodized aluminum.
- Where painted assemblies are required, use durable factory finish (preferred), or a marine grade system:
 - Electrostatic painting.
 - Factory pre-painted process.
 - Epoxy coat and aliphatic urethane topcoat, marine grade system. For increased durability, consider galvanized steel for painted assemblies.

Interior Concrete Horizontal Surfaces: Floors and stairs

- INT 3.2G - Waterborne concrete floor sealer semi-gloss finish.

Interior Concrete Masonry Units: Smooth and split face block and brick

- 1 coat high-solids, pigmented block filler used full body, 3 mils DFT.
- 2 coats vinyl acrylic Latex enamel, 1.5 mils/coat DFT. Total 6 mils DFT. INT 4.2E - Institutional semi-gloss finish.

Interior Structural Steel and Metal Fabrications: Columns, beams, joists, etc.

- 1 coat shop applied, oil alkyd primer (metal surfaces already primed need only touch-up).
- 1 coat 100% acrylic emulsion, waterborne, corrosion resistant paint as tie-coat at 1.5 - 2 mils DFT.
- 2 coats acrylic emulsion finish at 1.2 mils/coat DFT. Total 3.9 - 4.4 mils DFT - INT 5.1S – Institutional semi-gloss

Interior Galvanized Steel: Hollow Metal Doors, Screens and Deck

- 1 coat 100% acrylic emulsion, waterborne, corrosion resistant primer at 2 mils DFT.
- 2 coats water reducible latex house and trim paint at 1.2 mils/coat DFT. Total 4.4 mils DFT. Semi-gloss finish at doors and screens. Flat finish at steel deck.

Interior Gypsum Board:

- 1 coat latex primer sealer at 1.0 mil DFT.
- 2 coats interior latex enamel at 1.5 mils/coat DFT. Total 4.0 mils DFT INT 9.2M - Institutional semi-gloss (general), eggshell (offices). Provide 3 coats at high contrast colours.

Painted Woodwork:

Division 09 – Finishes

- 1 coat under-coater, low-odour, pigmented, interior alkyd primer at 1.5 mil DFT. Back paint wood base.
- 2 coats interior latex enamel at 1.5 mils/coat DFT. Total 4.5 mils DFT.

Clear Finish for Wood:

- 1 coat sanding sealer.
- 2 coats water-based urethane gloss varnish at 2.0 mils/coat. Total 4.0 mils DFT.

Painted Concrete:

- 2 coats high-solids purpose made floor paint with non-slip surface.

Exposed Architectural Concrete:

- Seal concrete with anti-graffiti coating.

Insulated and Uninsulated Pipes, Ducts, Conduit, Valves, Fittings and Equipment and Ancillary Items where "Exposed" in Completed Work:

- Insulated Work: 1 coat latex primer sealer, 1 mil DFT. 2 coats interior latex enamel, 1.5 mils/coat. Total 4.0 mils DFT.
- Non-insulated Work: 1 coat structural steel primer, 1 mil DFT. 2 coats interior latex enamel, 1.5 mils/coat. Total 4.0 mils DFT.

Unless otherwise specified or noted, paint all “unfinished” conduits, piping, hangers and other mechanical and electrical equipment with colour and texture to match adjacent surfaces, in the following areas:

- Where exposed-to-view in all exterior and interior areas.
- In all interior high humidity interior areas.
- In all boiler room, mechanical and electrical rooms.

Painting of mechanical and electrical work is part of this Division, the following minimum criteria is to be included in this Section: *** reference section in 15 and 16.

- Schedule paint finish for all equipment, piping and ducting exposed in equipment rooms or exterior exposed not pre-finished. Do not require paint finish for flexible ducts, connections, isolators, label all components concealed from public view, above ceilings, and areas not colour coded with paint finish.
- Schedule mechanical work exposed in rooms to be painted with the selected room colours.
- Colour code to FMP Colour Code Standard. Specify alkyd or heat resistant paint with primer. Apply a two-coat paint finish according to Paint Code Specification.

Electrical Work:

- Specify components pre-finished. Schedule paint finish for all unfinished equipment or exterior exposed to match adjacent finish. Do not require paint finish for flexible connections.

Mechanical Piping and Ducting:

- All exposed, insulated or uncovered, pipes or ducts, iron and steel surfaces; and equipment not arriving on site with factory enamel finish shall be painted, unless specifically requested otherwise by FMP.
- The colours shall be as outlined in the following colour schedule. The use of white, off-white or basic room colours on piping and equipment will be acceptable only if requested specifically by the FMP.
- Six basic colours shall be used, four of which conform to ASA Standard A13 and CSA Standard B53-1958. In addition off-white and pearl grey will be used. The Canadian Government Specifications Board CGSB, paint colour identification which define colours to be used are:

Classification Colour	Standard Colour
yellow	505-101
green	503-107
blue	202-101
red	509-102
off-white	
pearl grey	

Colour Identification Schedule Service	Colour
Air Ducts	off-white
Air Tanks	off-white
Blow Down Tanks	yellow
Carbon Dioxide Lines	yellow
Chilled Water Lines	green (dark)
Chlorine	yellow
Compressed Air (process or control)	green (dark)
Condensate Lines	yellow
Condensate Tanks	yellow
Condensate Pump Discharge	yellow
Condenser Water	green (dark)
Cooling Water	green (dark)
Demineralized Water	green (light)
Domestic	green (light)
Domestic Cold Water	green (light)
Domestic Hot Water	yellow
Drinking Water	green (light)
Dry Stand Pipe	red
Dust Mop Pearl	grey
Exhaust Gas	yellow
Expansion Tanks	off-white
Fans	blue

Fire Protection Water	red
Freon	green (dark)
Fuel Oil	yellow
Glycol	yellow
Hot Water Tanks	yellow
Heating	yellow
Heat Exchanger	yellow
Heating Hot Water	yellow
High Pressure Air	green
High Pressure Steam	yellow
Hot Water	yellow
High Temperature Hot Water	yellow
Low Pressure Condensate	yellow
Low Pressure Steam	yellow
Lube Oil (SAE-30)	yellow
Medium Pressure Steam	yellow
Natural Gas	yellow
Nitrous Oxide	green (dark)
Nitrogen	green (dark)
Oxygen	green (dark)
Pumps	blue
Standpipe Wet	red
Standpipe Dry	red
Sprinklers	red
Sprinkler Fire	red
Sprinkler Water	red
Steam	yellow
Structural Supports	pearl grey
Tower Water	green (dark)
Vacuum	green (dark)
Wet Stand Pipes	red

- Use sufficient drop cloths and protective coverings for full protection of floors and work not being painted.

End of Section

Division 10 – Specialties

All new construction and renovation projects on Carleton University campuses are required to meet the Carleton University Facilities Design Guidelines. Including from the initial planning and design stages through to the various phases of construction and facilities maintenance and management. They are to mirror planning, design, construction, maintenance, and other facilities supporting University personnel. These documents are to be used as a guideline only on all Carleton University projects and are not to be used for bidding, permitting construction, or any other purpose. Any changes or substitutions must be approved by Carleton University Facilities Management and Planning (CUFMP) and must be submitted in writing. This document is the property of Carleton University. Any use of this document, in part or in whole, for purposes other than a Carleton University project cannot be done without written permission from the University.

Table of Contents

10 11 13 - Chalkboards	3
10 11 23 - Tackboards	3
10 14 00 - Signage	3
10 14 53 - Traffic Signage	3
10 21 00 - Compartments and Cubicles	3
10 22 00 - Demountable Partitions	5
10 22 33 - Accordion Folding Partitions	5
10 26 00 - Wall and Door Protection	6
10 28 00 - Toilet and Bath Accessories	8
10 51 13 - Metal Lockers	9
10 75 00 - Flagpoles	10

10 11 13 - Chalkboards

- .1 Provide chalkboards complete with dividers, perimeters, map rails with Krommenie cork inserts with end stops and one roller map hook per metre, and chalk trays complete with end caps.
- .2 12.7mm thick porcelain enamel writing board of porcelain enamel writing face sheet 0.127mm thick completely fused to 22 gauge enamelling steel base.
- .3 Porcelain writing surface shall be in accordance with the Porcelain Enamel Institute Standards PEI S104 and to the stand of the manufacturer. Core of 11mm impregnated fibreboard to which writing face and back sheet are factory laminated under pressure using waterproof adhesive. Back sheet of 28 gauge stretcher levelled zinc coated steel in one piece. Join boards together with 25mm x 14 gauge steel splines.
- .4 Ensure all seams are closely aligned. Aluminium trim shall be 6063 T5 aluminium alloy with satin finish clear etched and anodized.
- .5 All chalkboards are to be green colour.

10 11 23 - Tackboards

- Consult with Facility Management and Planning's Space Planning Group

10 14 00 - Signage

- Consult with Facility Management and Planning's Space Planning Department

10 14 53 - Traffic Signage

- Consult with Facility Management and Planning's Space Planning Department

10 21 00 - Compartments and Cubicles

Description

- .1 Provide toilet partitions and urinal divider screens.
- .2 Coordinate with rough carpentry, sealants and washroom accessories.

Warranty

- Warrant product by manufacturer for a total period of three (3) years against defects in design, materials and workmanship.

Design Criteria and Notes

- .1 Toilet Compartments
 - i. Shall be designed for heavy traffic, shall have superior durability, reparability and be scratch-resistant, dent-resistant, graffiti-resistant, moisture-resistant and impact-resistant. Use finishes that require minimal maintenance and allow easy graffiti removal.
 - ii. Design stalls size to allow adequate installation and functionality of all accessories.
- .2 Toilet Partition Types
 - i. All toilet partitions to be gap free with continuous hinges.
 - ii. Latches must be operable from the exterior in an emergency.
 - iii. Typical: Solid Colour Reinforced Composite (SCRC), solid phenolic, solid plastic or plastic laminate, to suit budget.

- iv. Acceptable for non-public, limited budget projects or to match existing: powder coated steel.
- .3 Washroom Partitions:
 - Floor-mounted overhead braced.
- .4 Urinal Partitions:
 - Wall hung.
- .5 Each compartment to be complete with the following hardware:
 - i. Combination coat hook/door bumper. Locate at 915mm height on inside of stall door in accessible stalls.
 - ii. Combination stop/latch – with emergency lift feature.
 - iii. Non-removable self-closing hinges – with emergency lift feature.
 - iv. Door d-pulls on interior and exterior of stalls for accessible compartments.
 - v. Seat at dressing cubicles.

Products

Pursue the use of sustainable materials with high recycled content.

- Toilet Partition Style: Floor mounted, overhead braced or ceiling mounted with continuous hinge.
- Urinal Divider Screen Style: Wall mounted. Custom shelf across top of dividers, 250 mm deep.
 - Construction: Doors, Panels and Pilasters shall be constructed of two sheets of panel flatness zinc-coated steel, galvaneal ASTM A653 GR33, laminated under pressure to a honeycomb core for sound deadening and rigidity. Formed edges to be welded together and inter-locked under tension with a roll-formed oval crown locking bar, mitered, welded and ground smooth at the corners. Honeycomb to have a maximum 25 mm cell size.
 - Doors: 25 mm thick with cover sheets not less than 0.8 mm (22-gauge).
 - Panels: 25 mm thick with cover sheets not less than 0.8 mm (22-gauge).
 - Pilasters: Shall be 32 mm thick with cover sheets not less than 1.2 mm (18-gauge).
 - Hardware and Fittings: All panel and pilaster brackets and all door hardware shall be chrome plated zinc die castings.
 - i. Fasteners: Zinc plated, chrome plated or stainless steel. 6-lobe security screws.
 - ii. Hinge: Adjustable gravity type, mounted on the lower pilaster hinge bracket, fully concealed within the thickness of the door. Threaded upper hinge pin shall have a metal core and self-lubricating nylon sleeve to ensure smooth, quiet operation
 - iii. Coat Hook: 102 mm x 50 mm x 110 mm, Model# 843.65.600 by Hafele. Matt nickel finish. Provide on each door.
 - iv. Latch: Concealed latch, with face mortised flush with edge strip of door. Barrier-free doors shall include thumb turn lever to activate latch without fingertip grip application. Both standard and barrier-free latches shall have a turn slot designed to allow emergency access from exterior.
 - Provide door stop and keeper.
 - Pilaster Shoe: Minimum 102 mm high, welded one-piece polished stainless steel.
 - Door Pull: "C" type on out swinging doors.
 - Finish: All sheet metal to be thoroughly cleaned, phosphated and finished with a

high-performance poly-urethane anti-graffiti powder coating, electrostatically applied and oven cured to provide a uniform smooth protective finish. Colour from complete range.

10 22 00 - Demountable Partitions

Extended Warranty

- Demountable Partitions components, including doors, door frames, door hardware, electrical, communications and plumbing accommodations shall be guaranteed for a period of 10 years.

Design Criteria and Notes

- .1 Partition system to be fully demountable and reloadable, non-progressive, extend in four directions at posts without disturbing other panels, accommodate floor/ceiling height variations of 25 mm (1").
- .2 Components to be non-combustible, distortion free, uniform in dimension, construction and appearance.
- .3 Partition system to accommodate electrical outlets on posts or base, and wiring in posts, base and cap.
- .4 Carry out additional regular steel stud, structural steel stud (09 20 00), miscellaneous steel or any similar reinforcement as necessary at head of partitions to provide adequate structural resistances.

Products

Demountable Partitions: Modular insulated panels made of thin, anodized or pre-painted aluminium posts, with vertical and horizontal reveals, including:

- i. Solid fascia in laminate or veneer.
- ii. Acoustic and fabric fascias with sound-absorbing and sound-blocking properties.
- iii. Tempered or laminated glass, clear or frosted (08 80 00) fascias, double-sided or single-centered.

Suggested (or equivalent) products:

- "Altos" by Teknion.
- "Dirtt Systems" by Dirtt.

10 22 33 - Accordion Folding Partitions

- .1 Consult with FMP before operable partitions are specified.
- .2 Specify folding panel partitions where good acoustic control is required, and accordion pantograph types for vision control.
- .3 Design folding panel operable door or wall systems of high-quality materials.
- .4 Specify manually operated; with perimeter sealing; a 40 decibel acoustic rating for sound loss; vinyl fabric or wood panelled surface finish to match adjacent wall finish; plastic or metal base.
- .5 Specify accordion pantograph partitions with fabric covered metal frames.

10 26 00 - Wall and Door Protection

Description

- Provide corner guards, door protection and wall protection for drywall applications in all public spaces.

Quality Assurance

- Provide each element as complete unit produced by single manufacturer, including fittings, accessories, bases and anchorage devices.

Design Criteria and Notes

- .1 Pursue the use of sustainable materials with high recycled content.
- .2 For Metallic elements, refer to Metal work related Section.
- .3 For Plastic elements:
 - i. Fire Performance Characteristics: Comply with specified requirements of ASTM D 256 for impact resistance and ASTM E 84 for the following:
 1. Flame Spread: 25 or less.
 2. Smoke Developed: 450 or less.
- .4 Corner Guard: Surface mounted, full height standard 90 mm x 90 mm legs, 1.3 mm thick (16 gauge) stainless steel angle in accordance with ASTM A276-10, Type 304, AISI No. 4 satin finish, radius edge. Use continuous adhesive.
- .5 Door Protection: Stainless steel mop, kick or armour plate with de-burred edges.
 - i. Application:
 1. All exposed corners within circulation areas where there is a high likelihood of impact to corners of walls.
 2. Leading into caretaking/housekeeping, mechanical and electrical rooms.
- .6 Mop Sink Wall Guard: 0.9525 mm thick (20 gauge) stainless steel angle in accordance with ASTM A276-10, Type 304, AISI No. 4 satin finish. Minimum 610 mm high.
- .7 Wall Protection: Provide wall protection in public areas and classrooms where chairs are present near walls to prevent wall finish damage. Install 28" to the underside in rooms with table height tables and chairs. Install bumper rail/wall protection at 35"- 40" to the underside in rooms with counter or bar height tables and chairs.
- .8 Adhesive: Low VOC.

Products

- .1 Corner Guards
 - i. Stainless Steel Corner Guards: In satin finish, surface mounted, 1.5 mm thick (16 gauge) min, 3-1/2" (89mm) wing, with beveled edges.
 - Suggested (or equivalent) products:
 1. "SCO-8 Series" by Construction Specialties Inc.
 2. "Stainless steel Corner Guard GS series" by Korogard.
 - ii. Aluminum Corner Guards: In anodized Aluminum in satin finish, 4mm thick, 1/2" x 1/2" (12.7mm x 12.7mm), with a standard 90° angle.
 - Suggested (or equivalent) product: "Anodized Corner Guard" by Korogard.
 - iii. Vinyl Corner Guards: In extruded acrylic modified vinyl plastic sheets, 078" (1.98mm) thick vinyl or 2-1/2" (63.5mm) wing, mounted over extruded plastic retainer.

- Suggested (or equivalent) product: "IPC Series" BY INPRO CORP.

.2 Wall Bumpers

- iv. Crash Rail Bumper Extrusion: Made of Extruded, rigid, impact-resistant plastic, nominal 0.078 inch (1.9 mm) thick or Stainless-steel type 304 with #4 Satin finish, 16 gauge, or aluminum, .250 inch (6.4 mm) thick, 5052-H32 with powder-coated finish, mounted over continuous aluminum retainer and two continuous vinyl bumper cushions. Sizes as indicated.

- Suggested (or equivalent) product: "Crash Rail C series" by Korogard.

.3 Protective Wall Coverings

- v. Homogeneous vinyl wall covering: Vinyl/Acrylic: Rigid sheet should be high impact, nominal .040" (1.02mm) minimum thickness. With color-matched vinyl/acrylic trim as needed for joint/transitions.

- Suggested (or equivalent) products:

.1 "Acrovyn" by Construction Specialties Inc.

.2 "500 or 600 series" by Korogard.

.3 "IPC Series" BY INPRO CORP.

10 28 00 - Toilet and Bath Accessories

Design Criteria and Notes

- .1 All lockable accessories shall be keyed alike.
- .2 Use tamper proof theft proof stainless steel screws/bolts for exposed fasteners, and corrosion resistant type for concealed fasteners.
- .3 Apply Sealant (07 90 00) around all accessories.
- .4 Do not use wood for the installation of the accessories.
- .5 Not acceptable:
 - i. Manufacturer's or brand names on face of units.
 - ii. Wall recessed or semi-recessed accessories or features. Only surface mount.
 - iii. Stainless Steel, aluminum or any shiny metallic surface difficult to clean.

ITEM	REQUIREMENTS
Toilet tissue dispenser:	Supplied by Carleton University
Paper towel dispenser:	Supplied by Carleton University (<i>special request</i>)
Waste receptacle or counter built-in	Not allowed
Towel waste receptacle:	Surface mount wall unit; Rubbermaid Series 7822
Soap dispenser:	Wall mounted; supplied by Carleton University
Feminine napkin disposal bin:	Bobrick Model B-5270 or Twincee Model 03305
Grab bars:	32mm dia. x 1.6mm wall tubing of stainless steel, 38mm dia. wall flanges, concealed screw attachment, flanges welded to tubular bar, provided with steel back plates and all accessories. Knurl bar at area of hand grips. Grab bar material and anchorage to withstand downward pull of 2.2 kN
Hand dryer:	American Dryer eXtremeAir GXT or EXT models. They come in heater and no heater configurations, adjustable speed offering. <u>Common Areas</u> – Hispeed <u>Office Areas</u> – Adjustable/Quieter
Mirrors:	Individual mirrors above sinks, not continuous.
Fixtures:	See Division 22

10 51 13 - Metal Lockers

Description

- .1 Provide lockers.
- .2 Coordinate with Insulation and Architectural Woodwork.

Design Criteria and Notes

- Specify metal lockers, single or double tier depending on specific use requirements, standard manufactured sizes, metal base, sloped metal top, silent nylon catches, with a device for padlocking. Units must be of welded construction with double-walled door assemblies.

Products

- .1 Pursue the use of sustainable materials with high recycled content.
- .2 Knock down 16 gauge construction with individual top, bottom, side, back and shelves with a common side separating compartments. Perimeter ventilation.

Types:

- i. Type 1A: Single tier units, 305 mm wide x 455 mm deep x 1830 mm high.
- ii. Type 1B: Single tier units, 380 mm wide x 455 mm deep x 1830 mm high.
- iii. Type 2A: Two-tier units, 305 mm wide x 455 mm deep x 1830 mm high.
- iv. Type 2B: Two-tier units, 380 mm wide x 455 mm deep x 1830 mm high.

Base: Integral 90 mm high galvanized metal box.

Door Hinge: Continuous.

Latching: Single point latching/locking device for padlocks. AODA compliant.

Coat Hook: Three (3) separate – one on each wall.

Shelf: Perforated upper. AODA compliant installed height.

Fastening: Concealed fastenings and heavy duty anchors suited to wall construction.

Number Plates: AODA compliant, raised or recessed colour contrasting lettering.

All required bench/pedestal, spacers, closure/filler panels and trim for complete installation.

10 75 00 - Flagpoles

Description

- .1 Provide aluminum flagpoles.
- .2 Coordinate with concrete.

Quality Assurance

- Provide each flagpole as complete unit produced by single manufacturer, including fittings, accessories, bases and anchorage devices.

Products:

- .1 Pursue the use of sustainable materials with high recycled content.
- .2 Aluminum: Aluminum Association alloy AA 6063-T5 seamless extruded aluminum tubing.
- .3 Isolation coating: Alkali-resistant bituminous paint or epoxy resin solution.
- .4 Cone tapered flagpole:
 - i. Seamless, uniform, straight line tapered section above cylindrical butt section.
 - ii. Taper: 25 mm of run.
 - iii. Provide internal splicing, self-aligning sleeve of same material as flagpole for snug fitting, watertight field joints.
- .5 Include base, mounting bracket, anchorage and fittings.

End of Section

Division 12 – Furnishings

All new construction and renovation projects on Carleton University campuses are required to meet the Carleton University Facilities Design Guidelines. Including from the initial planning and design stages through to the various phases of construction and facilities maintenance and management. They are to mirror planning, design, construction, maintenance, and other facilities supporting University personnel. These documents are to be used as a guideline only on all Carleton University projects and are not to be used for bidding, permitting construction, or any other purpose. Any changes or substitutions must be approved by Carleton University Facilities Management and Planning (CUFMP) and must be submitted in writing. This document is the property of Carleton University. Any use of this document, in part or in whole, for purposes other than a Carleton University project cannot be done without written permission from the University.

Table of Contents

12 20 00 - Window Treatment.....	3
12 35 00 - Laboratory Furniture	5
12 48 00 - Entrance Grilles.....	16
12 50 00 - Furniture	17

Notes:

All furnishings and associated layout and finishes must be approved by CU SMCP.

12 20 00 - Window Treatment

General

Design Criteria and Notes:

- .1 Secure aluminum components with non-corrosive metal fasteners for installation, concealed infinal assembly.
- .2 When installed on multi-mullion windows, any joint between two fabric pieces shall occur only at center line of an intermediate mullion.
- .3 Design brake to stop and hold blinds in any position.
- .4 In general:
 - .1 Motorized Shading Systems to be used in areas that are hard to reach or in rooms where there is a large span of windows where the shades would always have to be drawn up or down at the same time (Classrooms, Laboratories, and similar).
 - .2 Manual Shading Systems to be used in public spaces, with a mechanism that can be controlled by chain but also pulled down manually, as it does not jam if a student pulls on the shade.
 - .3 Blackout Shading Systems to be either motorized or manual depending on access. Blackout shades to have light control channels at side and top of screen to prevent light infiltration at mullions and window frame. (specialty classrooms, theatres or laboratories when sunlight needs to be blocked out 100%)

Products

- .1 Shading Systems, Manual or Motorized: Chain operated and sprocket roller shading system with infinite positioning, or with motor. Fabric in Shade cloths woven of .018 opaque, vinyl coated polyester yarn consisting of approximately 79% vinyl and 21% 500 denier polyester core yarn. Percentage of openness: 3%, 1% and 0%.
 - Suggested (or equivalent) products:
"Sheerweave 2410" (3%), "Sheerweave 2500" (1%), "Sheerweave 7500" (0%), as manufactured by SOL-R

Type 1: Facia Valance + Black out roller shades

- 100% polyester with acrylic flocked backing (PVC free)
12.4 oz/yd mesh weight 0.029" fabric thickness
- Opaque
- Typical Location: Residence bedrooms

Type 2: Facia Valance + Sun Control

- Vinyl-coated polyester yarn, 24% Polyester, 76% vinyl. 18.5 oz/yd mesh
Weight. 0.020" yarn diameter, 0.036" fabric thickness
- 1% openness
- Please provide a line that has 1%-10% openness range
- Typical Location: Offices and common rooms

Requirements applicable to all blind types:

- Dimensionally stable fabric
- Color selection from the manufacturer's full range tested in accordance with ASHRAE Standard 74073, "Methods of Measuring Solar-Optical Properties of Materials" and flame spread to NFPA 701-1999 TM#1, Standard Methods of Fire Tests for Flame Resistant Textiles and Films 1999 edition - test method #1 (Small Scale) Toxicity: UPITT Fungal resistance: ASTM G21 Bacterial Resistance, ASTM G22.
- Stainless steel ball chain operated, with infinite positioning- cord length to end 1500mm above finished floor.
- Left or right hand operation to future selection (to be coordinated with final furniture arrangements)
- Built in shock absorber system to avoid chain breakage under normal operation
- Include counter balancing mechanism to offset weight and allow for fingertip control
- Finish to match surrounding curtain wall frame or to future selection from manufacturer's full range
- Flammability rating to CAN/ULC S109-033 Large Flame Test
- Shades to snap into place without visible screws or fasteners
- Install true and level
- Fabric premeasured and manufactured off-site
- Greenguard Certified for low chemical emissions into indoor air quality
- Adhesives, sealants, paints and coatings to be low VOC.

End of Section

12 35 00 - Laboratory Furniture

General

Extended Warranty

- .1 All lab furniture and related accessories shall be guaranteed against all defects in design, material fabrication, and installation for a period no less than 5 years.

Design Criteria and Notes:

- .1 Criteria: Comply with all standards in this specification unless more stringent requirements are given herein. Work shall conform also to the following:
 - .1 Safety Guide for Laboratory Operations, Chapter 5.1, Treasury Board Manual, Occupational Safety and Health.
 - .2 Health Canada, Office of Laboratory Security, The Laboratory Bio-Safety Guidelines.
 - .3 ANSI/AIHA Z9.5 - American National Standard, Laboratory Ventilation.
 - .4 ANSI/NFPA 30 - Flammable and Combustible Liquids Code.
 - .5 NFPA 45 – Fire Protection for Laboratories Using Chemicals.
 - .6 SEFA-2.3 – Installation of Scientific Laboratory Furniture and Equipment, Recommended Practices.
 - .7 SEFA-3 – Work surfaces.
 - .8 SEFA-5.1 – Scope of Work.
 - .9 SEFA-7 – Laboratory and Hospital Fixtures.
 - .10 SEFA-8 – Laboratory Furniture Casework, Shelving, and Tables, Recommended Practices.
 - .11 OSHA applicable standards.
 - .12 EEMAC standards.
 - .13 Ontario Electrical Safety Code.
 - .14 CSA C22.1-02 - Canadian Electrical Code.
 - .15 "Quality Standards for Architectural Woodwork", for wood casework.
 - .16 AWI and CSA quality standards for finish carpentry and Plywood identification to be by grade mark.

Notes

- .1 An operational HVAC system that maintains temperature and humidity at occupancy levels must be in place. Relative humidity must be between 25% and 55% before product is brought on site.
- .2 Permissible variation is 1.5 mm in 3 meters (1/16" in 10'-0"). Bolt together casework, in such a way that joints between them shall not be wider than 1 mm (0.04").
- .3 Integrate existing cabinets into the new furniture (if applicable) and make necessary repairs.
- .4 Use non-corrosive screws and bolts for concealed fastenings.

- .5 No oils or waxes are to be used on finished installation.
- .6 Preference is for plug and play solutions to permit future reconfiguration flexibility to accommodate evolving research and innovation needs.

General

- .1 The Contractor / Manufacturer shall be a member of SEFA & AWI/AWMAC.
 - **Carleton University standard products:** As manufactured by:

- | | | | |
|----|-----------------|----|-------------------------|
| .1 | Bedcolab Inc | .2 | CIF Lab Solutions |
| .3 | Mottlab Inc | .4 | Duralab Equipment Corp. |
| .5 | Fisher-Hamilton | .6 | ICI Scientific |

Countertops, Table top (work surfaces) & Shelves

- .1 **General:**
 - .1 Tops shall be fabricated in as long a length as possible to minimize the number of joints. All joints shall be butt type and factory fitted to provide proper alignment onsite.
 - .2 Exposed edges and **Laboratory Sink (22 42 01)** openings surfaces shall be finished in same manner as specified for working surface of countertop material and faces shall have a drip groove on the underside.
- .1 **Countertops - Solid Phenolic Resin (Solid plastic Laminate) – Acid resistant:**
 - .1 Shall be 25 mm (1") overall thickness or more, with chamfered edges.
 - .2 Splashbacks of the same material shall be mechanically fastened to the counter and the resultant joints shall be sealed.
 - **Suggested (or equivalent) products:**
 - .1 "Arborite laboratory grade solid phenolic core", finish "CA" or "Diamond", by Arborite.
 - .2 "Laboratory grade 840/LGP Thick stock", black colour, finish "58" or "42", by Formica.
 - .3 "Trespa TopLab Plus" by Total Lab solutions.
 - .4 "Chemical resistant SPC" by Durcon.
- .2 **Countertops – Epoxy Resin - Acid and Heat Resistant:**
 - .1 Moulded, homogeneous, 100% modified epoxy resin boards, completely cured in processing, with at least 1.25 mm (0.05") thick (dry film) coating, very smooth finish, non-glazing, non-reflecting, without surface defects.
 - .2 Of 25 mm (1") overall thickness or more, with beveled edges, and with 32 mm (1¼") marine edges in fume hoods, extremities rounded 6.4 mm.
 - .3 Joints shall be welded with identical material.
 - **Suggested (or equivalent) product:** As manufactured by Chemtops.
- .2 **Countertops - Stainless Steel:**
 - .1 Shall be of 1.5 mm (16 ga) with closed edges and reinforced with 1.5 mm (16

ga) thick hat-shaped channels spaced 400 mm (16") o.c. maximum, and welded to the underside to avoid twisting or buckling with sound deadening. With integral splash backs, and milled to match the stainless steel counter tops, with a cove, at the junction with the countertop and shall have a total thickness of 19 mm ($\frac{3}{4}$ ").

- .2 The front edges and all other exposed or open ends of such tops shall have a raised rim or marine edge 25 mm (1") wide. From the extreme inward edge of the rim, a slope downwards of 30° shall be provided with a vertical drop of 6 mm ($\frac{1}{4}$ ").
Exposed edge shall be of 25 mm (1") total height.

Casework **General**

- .1 Units: Shall be interchangeable, rigid, and self-supporting.
- .2 Suspended Cabinets or on Casters:
 - .1 To be provided with steel hanging rails to match the correspondent framing system.
 - .2 To be provided with finished backs and bottoms made of similar materials.
 - .3 Suspended cabinets shall have a dust cover to enclose the top, made of similar materials, and units on casters shall have a finished countertop surface, with similar construction as the fixed countertops.
 - .4 Depending on the number shall be provided with 2 cabinet transfer carts that will allow for installation, removal, and relocation of suspended cabinets without tools or removal of contents of cabinets.
- .3 Additional notes for Stainless Steel units
 - .1 Shall be of similar construction to that of prepainted steel furniture.
 - .2 All base cabinets and other furniture, including those with drawers and with sinks, shall be sealed units.
 - .3 Joints in exposed stainless-steel cabinet surfaces shall be ground and polished to the same finish as the rest of the surfaces. All stainless-steel nuts, screws, bolts, rivets, etc., shall be of the same type stainless as in the sheet material.
 - .4 All stainless-steel welding material shall be of type similar to the sheet material, by the argon arc process. To be continuous, crevice-free, ground and polished to the original finish of the surface. Fillers, solders or spot welding will not be permitted. **Base cabinets, wall cabinets or floor cabinets**

.1 Units in Prepainted Steel or Stainless Steel:

- .1 Casework:
 - .1 Each unit shall be a completely welded structure. Under hood base cabinets must be capable of supporting the weight of the fume

hoods and their contents.

- .2 All metal surfaces shall be isolated from direct contact with dissimilar metals, concrete and masonry.
- .3 No exposed horizontal structural cabinet members between doors and drawers shall be accepted.

.2 Internal shelves:

- .1 Shelves shall be mild steel of a similar finish to the cabinets, with edges turned down on all four (4) sides 19 mm and shall return under on the front and back 16 mm (5/8"). Shelves shall be adjustable on 16 mm (5/8") increments and shall be full depth and width of the interior. A minimum of four (4) zinc plated shelfclips per shelf shall be provided.

.3 Doors:

- .1 Hinged doors shall be double-wall telescoping construction 19 mm (3/4") thick, with the front panel and inner liner formed on four sides. All interior surfaces shall be painted before assembly. Doors shall be sound-deadened on the interior.

.2 Sliding doors:

- .1 To be easily removable, without having to remove shelving, and bumpered.
- .2 Frameless sliding Glass doors shall be with "H" shaped extruded aluminum shoes fixed to and running the full width of door bottom.
- .3 Sliding doors, with or without glazing, shall have a hollow metal frame 19 mm x 32 mm. same finish as adjacent.

.4 Drawers:

- .1 Drawer bodies shall be reinforced and spot-welded to the inner drawer front and back panel. Fronts shall be 19 mm (3/4") double pan construction sounddeadened, consisting of two telescoping metal panels (painted inside and out). All interior surfaces shall be painted before assembly.

.5 Basic thicknesses: In general, metal used in the construction of cases shall be of the following minimum gauges:

- .1 Front support rail: 3 mm.
- .2 Case ends, bottoms, tops, vertical posts, uprights, filler panels, shelves, door.
panels, glazed door frames and top rear corner gussets, back rails, intermediate horizontal rails: 1.2 mm (18 gauge / 0.048").
- .3 Exposed case tops, drawer suspensions, door and case hinge and

frontcorner reinforcement, and levelling device brackets: 1.5 mm (16 gauge /0.059").

- .4 Drawer bodies and cabinet backs: 0.91 mm (20 gauge / 0.036").

.2 Units in wood:

.1 Casework:

- .1 Wood core material shall be in medium density fibreboard (MDF) of 700-745kg/m3 density, minimum grade 130, FSC certified, minimum 75% recycled material content, free of added formaldehyde.

Finish to be:

- .1 Catalysed Vinyl Finish: Color to be selected from the manufacturer standard.
- Suggested (or equivalent) products: As manufactured by CIF
- .2 Thermally Fused melamine (TFM): High wear resistant resin Impregnated decorative sheet thermally fused to both faces of woodcore. Colour to be selected by Consultants.
- Suggested (or equivalent) products: Flakeboard
Thermally Fused Melamine
- .3 Plastic Laminate Facing: Plastic laminate sheet: regular grade (GPR), 1.15 mm (0.045") thick, colour as per Consultant's choice.
- Suggested (or equivalent) products: As manufactured by:

.1 Arborite	.2 Abet Laminati
.3 Wilsonart	.4 Formica
- .4 Plastic Laminate Facing with Resistance to Acid: Similar to material used for Countertops.
- .5 Wood Veneer Facing with Catalysed Vinyl Finish: 0.508 mm (0.02") thick rift cut, Book match pattern, clear Vinyl finish or stained, in Grade AA (with modifications to grade), White Maple (Plain Sliced), Grade A Birch (Rotary cut), European Steamed Beech (Plain Sliced) or Cherry (Plain sliced).

- .2 Edging shall be in 3mm solid PVC for Plastic Laminate Facing, Catalysed Vinyl, TFM units, or Solid wood, same type for Wood Veneer Facing units.

- .1 All cabinetwork shall be Full Flush overlay Modular Construction, factory assembled, using dowel construction. Overall thickness shall be as follow:
- .1 Sides: 19mm with 1mm solid edging on 4 edges
 - .2 Back: 19mm

- .3 Bottom: 19mm with 1mm solid edging
 - .4 Floor-mounted cabinets to have an integral for waterproof veneer core base.
- .3 Internal shelves:
 - Refer to Exposed Shelving articles.
- .4 Doors:
 - .1 Swinging:
 - In Catalyzed Vinyl, TFM units, or Plastic Laminate Facing, with an MDF core, or as indicated of same construction, thickness and finishes as casework, and 3mm similar solid edging on the perimeter.
 - .2 Sliding:
 - .1 Shall be easily removable, without having to remove shelving.
 - .2 Sliding doors, with or without glazing, shall have a wood frame, same composition as casework frame 19 mm x 32 mm. Or, Frameless sliding glass doors shall be with ground, polished edges and door pull.
- .5 Drawers:
 - .1 Faces: In Catalysed Vinyl, TFM or Plastic Laminate Facing, with a MDF core, thickness and finishes as casework, and 3mm similar solid edging on perimeter.
 - .2 System: Shall be in Plastic Laminate Facing with MDF core, Fully dovetailed drawer box, with 12mm TFM bottoms, or in Prepainted Steel

System and Frame Assemblies

- .1 Fixed Countertop Units:
 - .1 Post or Open Leg frame assembly, in Prepainted Steel or Stainless Steel: Consisting of special tubular frame system (50mm x 50 mm approx.) with prolonged posts (uprights) for shelf support, with hangers to accommodate Suspended Cabinets, with the following minimum gauges:
 - .1 Leg frames, uprights and different supports and connections: 2 mm (14 ga).
 - .2 Front and rear cabinet hangar rails: 2.7mm (12ga).
 - .3 Toe kick Plate: 1.5mm (16ga).
 - .4 Modesty panels (if applicable): 1.2 mm (18 ga).
 - .5 Wall and Isle Pilasters: 1.5mm (16ga), double slotted.
 - .2 Service panels in Prepainted Steel or Stainless Steel: To be flanged on all four sides and reinforced, 1.2 mm (18 ga) thick. Completely or partially

removable, without the use of tools and shall be bumpered to prevent rattling. To be part of the removable or on caster base cabinets. To be also provided for base cabinets in peninsular or split island benches, with or without electrical outlets.

- .3 Aprons for knee space, in Prepainted Steel or Stainless Steel: Unless otherwise noted, aprons, with or without drawers, to be 64 mm high maximum, to match adjacent units in material, design and finish.
- .4 Gable legs: Unless otherwise noted, shall be with same composition as the Casework. To be provided for exposed end Aprons.
- .5 Suspended Base Cabinets: Modular and interchangeable.
- .6 Floor-mount Base Cabinets: Modular, with continuous base.
Suggested (or equivalent) products:
 - .1 “Chorus” by Bedcolab In.
 - .2 “Sigma Flex” by MottLab Inc.
- .2 Mobile Countertop Units:
 - .1 Similar to Fixed Countertop Units, with adjustable legs or pads, and upper Sleeves for shelves and Suspended cabinets, serviced by the ceiling, with integrates services.
 - Suggested (or equivalent) products:
 - .1 “Symphony” by Bedcolab In.
 - .2 “Sigma Carts” by MottLab Inc.
 - .3 “Ascent Series Tables” by CIF Lab Solutions
- .3 Upper Units:
 - .1 Wall-mount Brackets in Prepainted Steel or Stainless Steel: Consisting of special adjustable tubular frame system (13mm x 50mm approx.) for shelf support, wall-mount cabinets, with hangers to accommodate wall-mount Cabinets, 2 mm (14 ga).
 - .2 Wall-Mount Cabinets: Adjustable heights, mount on Wall-mount Brackets, or on Postor Open Leg frame, with Sliding doors.

Exposed Shelving

- .1 Reagent shelving:
 - .1 Reagent shelves shall be of Plastic Laminate, provided with a 3mm solid PVC edges, or in Epoxy Resin, thickness and finishes as Countertops. Underside to be finished to match top, provided with stainless steel edges and trims.

- .2 Vertical supports shall be of the same material, 32 mm (1¼") thick.
- .2 Adjustable wood shelving:
 - .1 In Wood Veneer Facing, Catalysed Vinyl, TFM or Plastic Laminate Facing, with a MDF core. Shall be of same construction, thickness and finishes as Casework (19mm min.), and 3mm similar solid edging on perimeter. Shelves exceeding 914mm shall have 25mm thickness min.
 - .2 In Epoxy Resin, or Solid Phenolic Resin: Underside to be finished to match top, provided with stainless steel edges and trims. Thickness, finishes and compositions as described for countertops.
 - Suggested (or equivalent) product: "Vario system" by CIF.
- .3 Adjustable Prepainted section Steel or Stainless shelving: Shall be of similar construction and finishes as the cabinets, reinforced, to avoid deflection, supported on the slotted tubular steel upright.

Fume hoods

- .1 General:
 - .1 Fume hoods shall be provided with an airflow sensing, monitoring and alarm device.
Airflow sensor shall be of the direct measurement type i.e. velocity or pressure sensing. Where applicable system shall be integrated into room air supply/exhaust control system.
 - .2 Heated perchloric acid shall only be used in a laboratory specifically designed for its use and identified as "For Perchloric Acid Operations". Ref. NFPA 45- 6.11.1.
 - .3 Exhaust Fume-Hood ductwork should typically be made of 316L stainless steel or corrosion coated galvanized steel.
- .2 Control strategies: Must be compatible with the rest of the building automation system.
 - Standard product: As provided by Delta system.

Cabinets for Storage of Chemical Products

- .1 Cabinets for Corrosive (Acids and Bases) Storage: Shall be enameled prepainted steel or wood finish, except the whole of the interior shall be lined with 6 mm (¼") thick chemical-resistant panel liners, with stainless steel drainage basins, on the shelf and on the cabinet floor, with a 2" rim all around.
- .2 Base Cabinets, for Flammable (Solvent) Storage: Cabinets shall be of the same

construction and appearance as the corrosive storage cabinets. Cabinets shall also comply with NFPA's flammable and combustible liquids Code 30, and have ULC or Factory Mutual approvals and/or certification, lockable.

- .3 Also, refer to **ORM's** related guidelines for any additional requirements.

Cabinet Hardware

- .1 Nuts, Bolts and Washers: Shall be stainless steel.
- .2 Drawer and Door Pulls: Shall be recess mounted and shall be 100 mm (4") extruded anodized aluminum for baked enamel furniture, stainless steel for stainless steel furniture, and nickel plated for wood furniture.
- .3 Door Hinges:
 - .1 For Metal Furniture: 5 knuckle, removable, institutional type, semi-concealed, with unequal wings, stainless steel. Hinges shall be attached to doors and case with cadmium plated flathead machine screws.
For Wood Furniture: 3 knuckle, self-closing type, nickel-plated finish, casework hinges with mounting plates to provide overlay and height adjustment. minimum 170 deg.
 - .2 Quantity: Provide 3 hinges for doors 800 mm to 1300 mm high. 4 hinges for doors 1300 mm to 1800 mm high, and 5 hinges for doors 1800 mm to 2400 mm high.
- .3 Adjustable shelf supports:
 - .1 For Internal Steel Shelves: Seismic type, shall be cadmium or chrome plated steel for cabinets with baked enamel finish, and stainless steel for cabinets in stainless steel, or shall be gloss nickel finish, as recommended by Lab Manufacturer.
 - .2 For Internal Wood Shelves: Seismic type, Double Pin Polycarbonate locking shelf clip.
 - .3 For External Shelves Assemblies: Seismic type, Gables shall be 16ga with mounting pins, with finish to match supporting system leg frames or brackets.

General Accessories

- .1 Drying Racks:
 - .1 Drying Racks in Solid Phenolic Resin (Solid plastic Laminate): To be with a wall hanger bracket, and Pegs of 10 mm x 125 mm (3/8" x 5"). Pegs shall not be bonded into board, but shall be held securely by mechanical design, with horizontal trough at bottom of rack to catch drips, pitched to drain directly into sinks, in stainless steel, c/w drain basket accessories.

- Suggested (or equivalent) product: As manufactured by InterDyne Systems.
- .2 Drying Racks in Stainless Steel: To be with a wall hanger bracket and integral drip through. Pegs shall be 12 mm x 150 mm (1/2" x 6"), with interchangeable bases with horizontal trough at bottom of rack to catch drips, pitched to drain directly into sinks, c/w drain basket accessories.
 - Suggested (or equivalent) product: As manufactured by InterDyne Systems.

Service Chases and Air Returns

- .1 Service Chases and Air Returns In Prepainted Steel or Stainless Steel:
 - .1 To have at least 1.5 mm (0.059") thick with reinforcing and accessories as necessary, with stainless steel bases (sleeves) and access panels and be easily demountable to allow access to the services.

Support frames for mechanical services

- .1 Mechanical Support Frame In Steel:
 - .1 To be of adequate thickness, of cold rolled galvanized or prepainted steel box channel construction, spaced a maximum of 1220 mm (48") o.c. at all standard wallbenches, for service piping.
 - Suggested (or equivalent) product: As manufactured by Unistrut.

Plumbing Service & Fixtures

- .1 General:
 - .1 Plumbing fixtures shall meet ADA standards, and be vandal resistant.
 - .2 Standard identification of fixtures to be as per color schedule CGCB 1-GP-12c. classifying colors and markers to be easily seen from the floor.
- .2 Types:
 - .1 Refer to the Mechanical section for more details.

Electrical Accessories

- .1 General:
 - .1 All electrical accessories shall conform to AMEEC, ULC and CSA standards.
- .2 Types:
 - .1 Refer to the Electrical section for more details.

Finishes

- .1 Wood Veneer Facing Catalysed Vinyl, TFM or Plastic Laminate Facing: (As indicated).

- .2 *Stainless Steel Elements*: Unless otherwise indicated:
 - .1 To be in Polished Finish #2B (Grade 316L) for the *Countertops*, *Sinks*, *Cup sinks* and Electrical *Monument boxes*.
 - .2 To be in Brush Satin vertical grain finish #4 (Grade 304) for all other elements.
- .3 *Prepainted Steel Elements*: Finish shall be a high-grade laboratory furniture quality, chemically resistant polyester baked enamel, baked in a controlled high heat. Surfaces exposed to view (interior or exterior) shall receive one coat pigmented primer applied over carefully sanded surfaces followed by two coats of enamel. Surfaces not exposed to view shall have one coat of primer and one of enamel. Completed finish shall be highly resistant to acids, alkalis, salts and solvents.

End of Section

12 48 00 - Entrance Grilles

General

- .1 Provide recessed floor grilles at building entrances and vestibules.
- .2 Coordinate with concrete.

Design Criteria and Notes:

- .1 Depth minimum 19 mm to maximum 43 mm.
- .2 Loading minimum 180 kg (400 lb)/wheel. To be reviewed against stakeholder needs assessment.
- .3 The grilles shall withstand a force of 4.300 kN (966 lb/ft²) or 2.260 kN (508 lb/ft²), at a maximum span of 610 mm (2'- 0"), with a deflection not exceeding 1/190th of the span.
- .4 Grille assemblies to pass successfully salt fog test at 1000 hours as per ASTM B117.
- .5 Frame and grid to be recessed type, extruded 6063-T5 aluminum alloy. Tread rails to incorporate EPDM support cushion. Furnish anchors for attachment to concrete.
- .6 Foot grilles drainage basin to be coated with an Elastomeric Waterproofing Membrane (07 1000), or Cementitious Waterproofing (07 10 00). For special cases, and upon **Facilities'** approval, a recessed drainage pans with bituminous coating can be provided only if poured within the concrete.
- .7 Ensure recessed slab is level and square.
- .8 Coordinate top of grid surfaces with bottom of doors that swing across to provide ample clearance between door and grid.
- .9 Defer installation of floor grids until time of substantial completion of project.

Products

- .1 Foot Grilles: In aluminum extrusions, with self-cleaning grilles, anti-slip, with 1.05 coefficient of friction, and concealed supports. Sections to be mounted on hidden stainless steel hinges and have stainless steel lock notches and lifting hooks, with flush mounted inverted "T" frame, supplied with anchoring hooks and sound gaskets, factory installed. Including:
 - .1 Drainage Pan: In Aluminum 1.52 mm (16 ga) with 2 coats of bituminous paint on all surfaces in contact with the concrete, or Stainless Steel Polished finish #2b (Grade 316) as per AISI specifications.

Suggested (or equivalent) products:

- .1 One-Directional Pattern: "C0-40" of "Design Line", with "VV" frame and "GB-46" lock, by Bolar Canada Inc.
- .2 Two-Directional Pattern: "BSA-1", with "TT" frame, by Bolar Canada Inc.

End of Section

12 50 00 - Furniture

General

Carleton University will provide furniture layouts conforming to our standards. Carleton University will tender the project furniture with Procurement on a project basis. Carleton will work with the furniture Vendor and Consultant to coordinate electrical needs. Carleton will work with the furniture vendor and the client department for finishes selections and will advise the Consultant.

CU's Vendor Performance Expectations

Carleton University works with furniture vendors that provides the following services. All roles/services have a point of contact so that Carleton knows where to direct the specific questions.

Design Services:

The vendor is expected to provide an individual who is capable of performing site measurements, expertise on the best furniture suitable for the design intent, services to facilitate reconfiguring a space, various layout concepts, 2D's and 3D's of furniture in its configuration within a space. This individual should be the point of contact to ask design or product specific questions that will be answered within a timely manner. Email or phone call acknowledgement time= 1 business day. Quote turn around time = 1-5 days for smaller quotes, larger quotes 6-10 business days. These timelines are based on clear concise asks from Carleton.

Project Coordination:

The vendor is expected to provide an individual who has the ability to coordinate projects with Carleton and with Construction Management companies hired by Carleton. The project coordination will involve having a single point of contact with the vendor to facilitate delivery and installation, provide updates on lead times and backorders that cause delays, adjust the schedules as required by projects and facilitate storage requirements, if necessary. This role also involves a deficiency walk-through and a plan to resolve the items within the week. This role will also involve providing a schedule for each project to be transparent with installation timelines. Email or phone call response time= 1 business day.

Installation Services:

Carleton would prefer a vendor with an in-house installation team that has expertise and familiarity with the product being installed. An in-house core team with outside hired for larger products to facilitate install is acceptable.

Furniture Recycling Program

At the end of life cycle for furniture at Carleton, the vendor would remove the furniture from campus and either find re-use, repurpose or recycle as needed. Must have ability to take all types of furniture manufactures.

AutoCAD Files

Carleton University has a space database that must be kept up-to-date. All projects that are being completed by the vendor require the AutoCAD files reflecting the new furniture in the space. Regardless of who the project is completed by at the Carleton University, the CAD files must be sent to the Carleton University Space Coordinator.

ANSI/BIFMA

All products bid must meet or exceed ANSI/BIFMA standards and requirements related to office furniture and educational settings. Must meet but not limited to the ANSI/BIFMA standards sections below.

- [ANSI/BIFMA X5.1 Office Chairs](#)
- [ANSI/BIFMA X5.11 Large Occupant Office Chairs](#)
- [ANSI/BIFMA X6.1 Educational Seating](#)
- [ANSI/BIFMA X5.4 Lounge & Public Seating](#)
- [BIFMA X6.4 Occasional-Use Seating](#)
- [ANSI/BIFMA X5.5 Desk/Table Products](#)
- [ANSI/BIFMA X5.6 Panel Systems](#)
- [ANSI/BIFMA X5.9 Storage](#)
- [ANSI/BIFMA X7.1 Standard for Formaldehyde and TVOC Emissions](#)
- [ANSI/BIFMA M7.1 Standard Test Method for Determining VOC Emissions](#)
- [ANSI/BIFMA e3 Furniture Sustainability](#)
- [BIFMA G1 Ergonomics Guideline for Furniture](#)
- [BIFMA HCF 8.1 Healthcare Furniture Design – Guidelines for Cleanability.](#)

Furniture deficiencies will include but are not limited to:

- All garbage and packing have been removed from site
- All furniture pieces have been placed as per plan
No visible nails, staples or glue
- Furniture does not wobble, twist or creak
- All furniture is free from scuffs, scratches and chips
- Veneers and lamination are free from peels, chips and is cleanly applied
- All doors and drawers close properly
- All doors and drawers lock properly
- All electrical power modules are neatly placed with wire management and free of dangling wires
- All electrical components are working correctly.

Warranty

The Furniture Vendor is requested to provide clear warranty documentation for each component of products, supported by manufacturer. All maintenance and cleaning information to be provided. The expectation is a minimum of 5 years for 24/7 use on all products provided.

Eco-Friendly Furniture & Life Cycle

- As part of Carleton University's sustainability development, the goal is to acquire furniture standards that are environmentally responsible going forward. This includes but is not limited to the following: life cycle as it relates to cost management, durability guarantee, recycling of products and packaging and the ability to optimize the life cycle by reconfiguration, reuse and add components when required.
- Materials used for products contain no dangerous materials (lead, mercury, cadmium, and chromium, CFC, or HCFC in foam), nor dangerous flame-retardants.
- Manufacturing must meet standards for sustainable forest management and exclude products that release volatile compounds that are detrimental to the indoor air quality.
- Transport involves reducing the packaging weight and volume to improve the transportation related energy consumption
- Recyclable products and degradable products are preferred to support the sustainable end of life cycle.

Versatility

Versatility is very important and will be analyzed thoroughly. Points will be given for furniture that is not restricted by handedness, has complete re-configurability, has a number of available finishes per product, and various available handle styles. In addition, a higher score will be provided for furniture that has ease of re-configurability.

Upholstery – Panel fabric and Seating Fabrics

- All fabrics, vinyls and upholstery proposed to have a minimum of 100,000 Wyzenbeek double rub abrasion rating on panel systems, 200,000 double rub abrasion on task seating, meeting chairs and guest chair seating, and 500,000 double rubs on high traffic areas such as student lounge spaces and waiting areas. Upholstery stain guard and ink guard, minimum class 4 of wet and dry crocking, high piling resistance minimum of class 4, colour fastness to light minimum class 4 are required fabric qualities. The intention is to alleviate the restrictions that pricing in the lowest grade causes on the fabric selections while still having a high-quality fabric option to specify.
- Submitted pricing must include the manufacturer pricing for the following Carleton approved fabrics: Arc-Com Healthier Hospitals, Knoll Bleach Cleanable, Steelcase Foundation*, Carnegie Xorel, Luum Decoy, Geo/Sheard Genesis, Ennis Challenger, Momentum Silica Fabric and LDI Enviro-leathers. All maintenance and cleaning information to be provided. The fabrics proposed should accept Carleton's cleaning methods below.
- Campus cleaning uses cleaning products with hydrogen peroxide, all fabric should be 4:1

bleach cleanable at minimum to mitigate wear or damage to fabrics from routine and enhanced cleaning.

** If different manufacturers are proposed, they must be priced so that the same proposed fabrics can be used on the products. If not possible, the available fabrics must be clearly identified in Appendix A in order to avoid confusion during the finish selection process.

Laminate Surfaces and Finishes

- All laminate surface finishes (work surfaces, transaction top, and/or table tops) must be high pressure laminate (HPL) with straight edge trims for durability, minimum thickness of 1"+. HPL should be scratch resistant. Edge trim to be matching, straight PVC that prevents peeling and nicks to provide comfort for user. ABS trim is acceptable. Appropriate reinforcements to be provided for tables 54" and above to prevent the surface from bowing where needed. Low pressure laminate is acceptable for gables, modesty panels and storage casing. Storage tops and face fronts must be HPL. Work surfaces must include scallops or grommets available in left, center and right configurations with a cover to allow for ease or wires to be transferred below the work surface. For work surfaces within panel systems, the surfaces must be specified to include a 1" pinch space on 3 sides for height adjustable base to move with ease and without pinching wires. For example: if a 24"x 60" surface is requested within a panel system. The dimension should be 23" x 58".
- Laminate finishes proposed costs are required to represent the **full manufacturer range of finish selections for HPL laminate, including woodgrain and pearled finishes.**

Metal Finishes

All metal finishes to be powder coated **in manufacturer's full range including flat and metallic finishes.** Chrome or stainless-steel finish is acceptable on lounge seating that has it as a standard. Do not restrict the finishes with pricing.

Work Surface Supports

Work surface supports may be a combination of a height adjustable leg, fixed leg, gable, central beam, under mount, panel hung and/or a stacked/stage structure support dependant of the specified configuration. Fixed support legs must support the work surface to appropriate working height and be able to hide wires from power modules. These supports can be metal or of laminate construction, see the configuration specified for more details. The fixed or adjustable legs must be powder-coated painted (A-Frame, post legs, O-Leg, T-leg, C-leg). Panel Hung Surface Supports can be metal or laminate gables, metal legs, corner brackets and cantilevers.

Height Adjustable Table

Supports must be able to accept a keyboard tray and CPU holder. Height adjustable table base to be powder-coated paint with manufacturer's full range of colour options to be available. Height adjustable table to be T-Shape or C-shape. Base must be electric standard range of 27"-46" in height. Extended height of 25"-48" to be available. Must have basic up and down buttons with screen and minimum two memory settings available. Base to have levellers. Wire concealer

or cover to be included on tables that have visitor's access or exposed front edge. Must have the ability to integrate a power bar or have the power bar securely mounted in wire management.

Modesty Panels

Modesty panels to be available in full, 3/4 and ½ height from floor options. Modesty panel to leave no more than ½" gap between support and modesty start. Modesty shall be recessed minimum 6" to allow for visitor access knee space.

Panel Systems

Panel systems to consist of stacking panel frames and components to allow for versatility to reach height ranges as indicated in work station specification. Panels must consist of a base and a stacker or add-on. The requested components are to follow the dimensions below:

- Typical Panel heights requested: 36"H, 42"H, 51"H & 66"H.
- Base Frame: 30"-36", Stacker heights of 6"-15". Panel heights should not exceed 68" in height.
- Panels and trims must be powder-coated painted metal. All panels must have levelers that adjust up to 1". Systems furniture panels must have the ability to anchor to the wall (where configurations deem necessary) and/or support the work surface components.
- Panels must be able to accept fabric, glass and laminate elements within the frame. Panel element/fascia should be removable from frames to support versatility. Glass should be able to integrate into the panel frame and have a glass blade or fin option.
- Panels must line up with the work surface seams wherever possible. Panels 54" and above are discouraged. The preference is to have kits of smaller panels to allow for reconfigurations.
- Generally, corridor facing panels to be laminate finish. The preference is to have a longer fascia to hide panel seams. Gaskets to hide slots are preferred. Interior base finish to be fabric finish. Wing panel and corridor facing panels to have upper elements as single (or double) sided glass element. Spine uppers to be tackable fabric elements. Accessory elements may also be requested.
- Integrated panel power and data to be located on middle spine unless otherwise indicated. Power must comprise of data punch-outs and a minimum two duplexes. Each station to have minimum of two separate circuits. Location of power must not interfere with storage components.

Freestanding Screens

Freestanding to have low profile support to minimize tripping hazards. Freestanding screens can be whiteboard, laminate, acrylic, or fabric covered. If freestanding screens are to have castors, the castors must be suitable for hard floor and carpet surfaces and lockable.

Whiteboards

All whiteboards must have an anti-stain, anti glare and magnetic surface. Whiteboard can be wall-mounted or mobile. Mobile whiteboards to have a base that must have a low profile to avoid tripping hazards.

Lounge Furniture

Lounge furniture provided must be robust and suitable for 24/7 use and be priced in a 500,000 double rub fabric option. Upholstery stain guard and ink guard, minimum class 4 of wet and dry crocking, high piling resistance minimum of class 4, colour fastness to light minimum class 4 are required fabric qualities

Healthcare Setting Requirements:

All Lounge style furniture and soft seating to be considered as healthcare standard with clean out gaps, sealed seems, ink guard, stain guard and moisture barrier/treatment. All proposed fabric and upholstery is required to have no deep crevices to ensure cleanliness of the fabric and furniture within the space based on new requirement to prevent the transmission of bacteria and viruses being spread. For seating with upholstered seat and backs, vendor pricing to include at a minimum dual upholstery (two separate finishes, i.e. fabric A on seats and fabric B on backs) as part of the standard.

Task & Meeting Chairs

Task Chairs must follow ergonomics requested in Appendix A. Task chairs must have a minimum of 200,000 double rub rating. Task chairs and meeting chairs to be on a star base, black nylon and aluminum base.

Guest Chairs

Guest chairs must have a flex back for comfort. If fabric is specified, then minimum of 200,000 rubs is required. If polypropylene is specified, please price so that manufacturer's full range of colour options are usable.

Storage

Metal and laminate storage to have appropriate counter weights as required by the manufactures. All pedestal and towers to include file hangers and pencil trays in each appropriate drawer. All storage doors and drawers to be lockable unless otherwise specified.

Drawers to have stops to prevent from pulling the doors too far. Drawers should be on good quality metal rails.

Collaborative & Meeting Tables

Tables to have levellers and or lockable casters suitable for the needs.

Task lights

A desk top option and an overheads option should be provided. The lights should be user friendly.

Keys

Each storage piece within an office or open space work station to have the same key/lock to open (keyed alike), unless otherwise specified. Two sets of keys per office/work station is required.

Power Requirements

All power requirements to be confirmed by Carleton. Where identified on plan provided, options for a wall outlet, floor outlet and base feed connection will be required. Power poles are not typically desired, but should be included as an option.

Dimensions

All dimensions provided have a (+/-) in order to allow manufacturers to use standard product. Dimensions should be used as a guide. The dimension differences do not need to be mentioned unless it's a specified width or depth that is not available in a panel, work surface or work surface related component. (IE Panel, worksurface and desk edge screen cannot be 18" W) This would be noted in the deviations. The idea is to use as much standard product as possible, but having the flexibility to customize as necessary.

End of Section

Division 14 – Conveying Equipment

All new construction and renovation projects on Carleton University campuses are required to meet the Carleton University Facilities Design Guidelines. Including from the initial planning and design stages through to the various phases of construction and facilities maintenance and management. They are to mirror planning, design, construction, maintenance, and other facilities supporting University personnel. These documents are to be used as a guideline only on all Carleton University projects and are not to be used for bidding, permitting construction, or any other purpose. Any changes or substitutions must be approved by Carleton University Facilities Management and Planning (CUFMP) and must be submitted in writing. This document is the property of Carleton University. Any use of this document, in part or in whole, for purposes other than a Carleton University project cannot be done without written permission from the University.

Table of Contents

1.0	Elevator Design	3
2.0	Elevator Control	3
3.0	Fire Alarm Control.....	4
4.0	Emergency Power	4
5.0	Barrier-Free Access	4
6.0	Cab Design (non-residence passenger elevators).....	5
7.0	Cab Design (residence passenger elevators)	7
8.0	Cab Design (service elevators)	9
9.0	Car Protective Pads	11
10.0	Car Operating Panel	11
11.0	Hall Buttons.....	12
12.0	Audible and Verbal Floor Announcement	12
13.0	Emergency Communication	13
14.0	In Car Camera.....	13
15.0	Sump Pit	13
16.0	Approved Elevator Manufacturer	13

1.0 Elevator Design

- .1 All designs shall be based on *CSA B44, Safety Code for Elevators, Ontario Building Code, Ontario Fire Code, TSSA Codes of Regulations*.
- .2 Elevators shall be overhead traction type with a traditional machine room above the hoistway or machine-room less type.
- .3 All elevator work shall comply with the TSSA elevating devices code, as well as all other code requirements dealing with safety (i.e. *OHSA – Confined Spaces*, etc.).

End of Section

2.0 Elevator Control

- .1 Specify solid-state non-proprietary controls with programmable micro-processor logic.
- .2 All elevators shall be provided with diagnostic monitoring devices.
- .3 The elevator control system shall not require any external proprietary service tools for maintenance or adjustments.
- .4 The elevator control system shall be serviceable and maintainable by any qualified elevator maintenance provider capable of maintaining elevator equipment of similar design and complexity.
- .5 The Elevator Contractor is to provide all information, and special tools to the University that is required for the safe and efficient maintenance of the elevator equipment, including any solid-state equipment, software or devices supplied under the specifications. The manufacturer is not to refuse any information, or the supply of parts, at fair market value, that is required by the University's Maintenance Contractor.
- .6 The Elevator Contractor is to permanently attach any service or diagnostic tool access code numbers to each controller at the completion of the project.
- .7 Any special tools, hand held devices, computers etc. required for the operation, testing, adjusting or setting parameters for the controller or car door operator must be left on-site in the machine room and will become the property of the University for future servicing and maintenance. All special tools are considered part of the elevator package.

End of Section

3.0 Fire Alarm Control

- .1 Based on the CSA B44 Elevator Code, O.B.C, N.F.C.
- .2 In conformance with Division 16 Electrical.

End of Section

4.0 Emergency Power

- .1 Minimum of one (1) passenger elevator with emergency standby power in buildings with more than seven (7) floors.
- .2 In conformance with Electrical Division.

End of Section

5.0 Barrier-Free Access

- .1 All passenger elevators to have provisions related to the *O.B.C. and the CSA B44 Elevator Code*.
- .2 All signs that pertain to the elevators will be designed to satisfy the needs of visually and mobility impaired users and shall be in both English and French.
- .3 All push buttons will be vandal-proof type, and in compliance with signage requirements.

End of Section

6.0 Cab Design (non-residence passenger elevators)

.1 General

- .1 Comply with clause 2.14.1 of ASME A17.1-2010 / CSA-B44-10 Safety Code for Elevators.
- .2 Fabricate complete car enclosure of minimum 1.9 mm sheet steel. Enclosure walls to be solid to permit removal of raised panels without revealing any wall openings. Comply with ULC Standard CAN/ULC-S102, Flame spread rating for cab walls and ceilings and ULC Standard CAN4-S102.2 Flame spread rating for cab floors.
- .3 All panels to be of the hang-on type, designed for removal from inside the cab. All fastenings to be concealed. Where screws must be used they shall be of the vandal resistant type.

.2 Ceiling

- .1 Specify ceiling with sheet steel, smooth and free from defects, minimum 1.9 mm thick. Manufacture the ceiling panel to be in one piece, white colour baked enamel finish, with final coat brought to semi-gloss. The emergency exit in the ceiling must be of the same material and finish.
- .2 Specify vandal proof type, drop ceiling panel with stainless steel n° 4 satin finish. Ceiling panel to be mounted as close as possible to the cab roof.
- .3 Specify flush mount MR-16 fixtures and warm white LED lamps. Removal of fixtures for replacement of lamps shall require a tool. Tool to be supplied as part of the project and left with the University.
- .4 Arrange panels to provide access to the emergency exit on the car top.

.3 Front return panel and car door

- .1 Clad return panels, transoms, headers and car doors with brushed stainless steel n° 4 satin finish or a textured stainless steel pattern approved by the University.

.4 Side walls

- .1 Provide on each side wall from the base plate to within 50 mm of the underside of the ceiling, **VERTICAL** applied panels covered with plastic laminate with colour choice and pattern to be chosen by the University or a brushed or textured stainless steel pattern to be chosen by the University. Provide stainless steel corner edge on panels.
- .2 Panels to be constructed of 11 mm FRPB as a minimum.
- .3 Provide corner reveals of approximately 50 mm between panels and corners. Clad reveal strips in 20 gauge stainless steel No. 4 satin finish.
- .4 Provide and install 150 mm high kick plates constructed of a minimum 11 mm high density fire rated board clad with brushed stainless steel No. 4 satin finish.

.5 Rear wall

- .1 Provide on the rear wall from the base plate to the underside of the handrail VERTICAL applied panels constructed of high density fire rated board and covered with plastic laminate with colour choice and pattern to be chosen by the University or a textured stainless steel pattern to be chosen by the University.
- .2 Panel to be constructed of 11 mm FRFB as a minimum.
- .3 Provide corner reveals of approximately 50 mm between the panels and the corners. Clad reveal strips in 20 gauge n° 4 stainless steel satin finish.
- .4 Provide ABOVE the handrail one (1) or more 6mm grey smoked safety mirror panels. Mirror to extend the width of the cab to meet the stainless steel corner reveals. Mirror panels to extend to the same height as the side walls panels. Alternatively, provide VERTICAL applied panels covered with plastic laminate with colour choice and pattern to be chosen by the University or a textured stainless steel pattern to be chosen by the University. Provide stainless steel corner edge on panels.
- .5 Provide and install 150 mm high kick plates constructed of a minimum 11 mm high density fire rated board clad with brushed stainless steel n° 4 satin finish.

.6 Entrance columns

- .1 Clad entrance columns in brushed stainless steel No. 4 satin finish or a textured stainless steel pattern. Pattern to be approved by the University.

.7 Handrails

- .1 Provide and install **tubular** stainless steel handrails on all non-access walls at a height of 900 mm above the finished floor. Return ends to walls at each end. Design handrail to be removable from inside the car. Space handrails 35 mm to 45 mm from the wall.

.8 Car sills

- .1 Specify Nickel-Silver car sills.

.9 Flooring

- .1 Specify *Poluflor Pearlazzo PUR* homogenous sheet flooring. Colour to be chosen by the University.

End of Section

7.0 Cab Design (residence passenger elevators)

.1 General

- .1 Specify at least one (1) elevator as a “Service Elevator” or with oversized interior dimensions with the capabilities for moving furniture and equipment.
- .2 Comply with clause 2.14.1 of ASME A17.1-2010 / CSA-B44-10 Safety Code for Elevators.
- .3 Fabricate complete car enclosure of minimum 1.9 mm sheet steel. Enclosure walls to be solid to permit removal of raised panels without revealing any wall openings. Comply with ULC Standard CAN/ULC-S102, Flame spread rating for cab walls and ceilings and ULC Standard CAN4-S102.2 Flame spread rating for cab floors.
- .4 All panels to be of the hang-on type, designed for removal from inside the cab. All fastenings to be concealed. Where screws must be used they shall be of the vandal resistant type.

.2 Ceiling

1. Specify ceiling with sheet steel, smooth and free from defects, minimum 1.9 mm thick. Manufacture the ceiling panel to be in one piece, white colour baked enamel finish, with final coat brought to semi-gloss. The emergency exit in the ceiling must be of the same material and finish.
2. Specify vandal proof type, drop ceiling panel with stainless steel n° 4 satin finish. Ceiling panel to be mounted as close as possible to the cab roof.
3. Specify flush mount MR-16 fixtures and warm white LED lamps. Removal of fixtures for replacement of lamps shall require a tool. Tool to be supplied as part of the project and left with the University.
4. Arrange panels to provide access to the emergency exit on the car top.

.3 Front return panel and car door

- .1 Clad return panels, transoms, headers and car doors with textured stainless steel pattern. Pattern to be approved by the University.

.4 Side and rear walls

- .1 Provide on each side wall from the base plate to within 50 mm of the underside of the ceiling, **VERTICAL** applied panels clad with textured stainless steel pattern. Pattern to be approved by the University. Provide stainless steel corner edge on panels.
- .2 Panels to be constructed of 11 mm FRPB as a minimum
- .3 Provide corner reveals of approximately 50 mm between panels and corners. Clad reveal strips in 20 gauge stainless steel No. 4 satin finish.
- .4 Provide and install 150 mm high kick plates constructed of a minimum 11 mm high density fire rated board clad with brushed stainless steel No. 4 satin finish.

Division 14 – Conveying Equipment

- .5 Entrance columns
 - .1 Clad entrance columns in textured stainless steel pattern. Pattern to be approved by the University.
- .6 Handrails
 - .1 Provide and install **tubular** stainless steel handrails on all non-access walls at a height of 900 mm above the finished floor. Return ends to walls at each end. Design handrail to be removable from inside the car. Space handrails 35 mm to 45 mm from the wall.
- .7 Car sills
 - .1 Specify Nickel-Silver car sills.
- .8 Flooring
 - .1 Specify *Polufloor Pearlazzo PUR* homogenous sheet flooring. Colour to be chosen by the University.

End of Section

8.0 Cab Design (service elevators)

.1 General

- .1 Comply with clause 2.14.1 of ASME A17.1-2010 / CSA-B44-10 Safety Code for Elevators.
- .2 Fabricate complete car enclosure of minimum 1.9 mm sheet steel. Enclosure walls to be solid to permit removal of raised panels without revealing any wall openings. Comply with ULC Standard CAN/ULC-S102, Flame spread rating for cab walls and ceilings and ULC Standard CAN4-S102.2 Flame spread rating for cab floors.
- .3 Provide minimum cab dimensions as follows:
 - i. Cab height of 2,743 mm.
 - ii. Height to underside of drop ceiling of 2,534 mm.
 - iii. Door height of 2,438 mm.
 - iv. Platform of 1,670 mm X 2,134 mm.
- .4 All panels to be of the hang-on type designed for removal from inside the car cab. All fastenings to be concealed. Where screws must be used they shall be of the vandal resistant type.

.2 Ceiling

1. Specify ceiling with sheet steel, smooth and free from defects, minimum 1.9 mm thick. Manufacture the ceiling panel to be in one piece, white colour baked enamel finish, with final coat brought to semi-gloss. The emergency exit in the ceiling must be of the same material and finish.
2. Specify vandal proof type, drop ceiling panel with stainless steel n° 4 satin finish. Ceiling panel to be mounted as close as possible to the cab roof.
3. Specify flush mount MR-16 fixtures and warm white LED lamps. Removal of fixtures for replacement of lamps shall require a tool. Tool to be supplied as part of the project and left with the University.
4. Arrange panels to provide access to the emergency exit on the car top.

.3 Return panels and car doors

1. Clad return panels, transoms, headers and car doors with textured stainless steel pattern. Pattern to be approved by the Architect.

.4 Side and rear walls

1. Provide on each side wall from the base plate to within 50 mm of the underside of the ceiling, **VERTICAL** applied panels clad with textured stainless steel pattern. Pattern to be approved by the University. Provide stainless steel corner edge on panels.
2. Panels to be constructed of 11 mm FRPB as a minimum.
3. Provide corner reveals of approximately 50 mm between panels and corners. Clad reveal strips in 20 gauge stainless steel No. 4 satin finish.

4. Provide and install 150 mm high kick plates constructed of a minimum 11 mm high density fire rated board clad with brushed stainless steel No. 4 satin finish.
- .5 Entrance columns
 - .1 Clad entrance columns in textured stainless steel pattern. Pattern to be approved by the University.
- .6 Handrails and truck rails
 1. Provide and install round or 150 mm x 6 mm flat stainless steel handrails on all non-access walls at a height of 900 mm above the finished floor. Return ends to walls at each end. Design handrail to be removable from inside the car. Space handrails 35 mm to 45 mm from the wall.
 2. Provide and install round or 150 mm x 6 mm flat stainless steel truck rails on all non-access walls at a height of 300 mm above the finished floor. Return ends to walls at each end. Design truck rails to be removable from inside the car. Space truck rails 35 mm to 45 mm from the wall. Spacing to match handrail spacing.
- .7 Car sills
 - .1 Specify Nickel-Silver car sills.
- .8 Flooring
 1. Provide and install minimum 6.4 mm thick aluminum checker plate flooring.
 2. Coat flooring with enamel floor paint to University's choice of colour.

End of Section

9.0 Car Protective Pads

1. Specify pad hooks to be installed in elevators.
2. Specify at least one (1) complete set of fire retardant protective pads covering all exposed wall surfaces and the front return panel (except the car station) and covering from 100 mm to approximately 2400 mm above the car floor.
3. Cab pads to be specifically manufactured to fit the service elevator or elevator that will most often be used to move furniture and equipment.

End of Section

10.0 Car Operating Panel

1. Locate all buttons in accordance with Appendix E, of the ASME A17.1-2010 / CSA-B44-10 Safety Code for Elevators.
2. Specify **Dupar US90 Jumbo** stainless steel **bi-colour white-blue** floor buttons. Provide square slim line raised numerals with braille to the left of each button. Where possible use international symbols. All other markings to be engraved on the faceplate in both official languages.
3. Common devices to be included in the car station are as follows:
 - i. Floor push buttons with integral illumination using **white-blue** LED type lights with a minimum 100,000 hour rating. Illuminate buttons with **blue** back lights and provide momentary audible signal when call is registered and extinguish the call when the car stops at the selected floor.
 - ii. Alarm, door open, and door close buttons. Mark buttons with appropriate symbols.
 - iii. Lens for Emergency Lighting System.
 - iv. Perforation holes for a hands free communication system. Provide and install a YELLOW International Telephone Symbol and engraved wording "PHONE". Provide and install an LED visual indicator and engraving, to indicate to persons with hearing disabilities that their call for assistance has been acknowledged. Phone button to be located between 890 mm and 1,220 mm above the floor.
 - v. A digital car position indicator. Indicator to display identical markings to car operating buttons, including all bilingual markings display letters and numbers for the digital position indicator in segmented format at least 50 mm in height and **blue** in colour. Use LED type, 100,000 hour rating, on a high resolution screen display. Arrange letters and numbers appearing on the indicator to illuminate in sequence and to transfer illumination instantaneously between floor levels.
 - vi. Audible signal to sound when the car stops at or passes a floor. Signal volume to be adjustable between 50 and 70 dBA.
 - vii. Where a card reader system will be used, a flush mounted, translucent, smoked Plexiglas 7 mm lens large enough to accommodate a new card reader (provided by others).
 - viii. Firefighter's Emergency Operation Panel.
 - ix. Visual and audible signal for Special Emergency Operation.

4. Provide in the car station, a service cabinet with a hinged door. **Carleton University will provide the Medeco key tumbler to be installed in the service panel door by elevator contractor.** Provide metal toggle and key switches inside the service cabinet, appropriately marked by wording or symbols, to control the following:
 - i. Car lights 2 position **toggle**.
 - ii. Test **button or key switch** for emergency lighting.
 - iii. Independent service two position **toggle**.
 - iv. Inspection **key** switch.
 - v. One GFI receptacle.
 - vi. Car ventilation fan 3 position **toggle**.
 - vii. One spare **toggle**.
 - viii. Stop **key** switch.
5. Engrave the following on the operating panel:
 - i. Elevator capacity in kilograms and number of persons.
 - ii. Elevator number in minimum 50 mm numerals.
 - iii. TSSA installation number and logo.
 - iv. Licence located in machine room in letters 12 mm in height. Engrave with black fill (bilingual).

End of Section

11.0 Hall Buttons

- .1 Specify hall call buttons with integral illumination, incorporating **blue** LED type lights with a minimum 100,000 hour rating, complete with boxes. Buttons to be of same design as car buttons complete with stainless steel faceplates.
- .2 Locate centreline of new buttons to be 1,066 mm above the floor.
- .3 Illuminate call button when call is registered. Extinguish illumination when call has been answered

End of Section

12.0 Audible and Verbal Floor Announcement

- .1 Specify verbal floor announcement as per clause E-10.3 of the ASME 17.1-2010 / CSA-B44-10 Safety Code for Elevators.
- .2 Provide announcements in English and French

End of Section

13.0 Emergency Communication

1. Elevators installed at Carleton University will have a shielded communication cable installed to be terminated in elevator cab and elevator equipment room.

End of Section

14.0 In Car Camera

- .1 Specify the provision in the travelling cables of sufficient wires for eventual connection of security video camera. The wires are to be terminated in a 20 x 20 box on the car top, permanently and legibly identified as camera wiring.

End of Section

15.0 Sump Pit

- .1 Specify the provision of a suitable pit drain and water-proofing. Where possible, sump pump to be located outside of the elevator hoistway and pit. Sump pump and drain must have the capacity to remove a minimum of 11.4 m³/hr (3,000 gallons per hour) or as required by current codes and standards (whichever is greater).
- .2 If the sump pump is located in the hoistway it must be provided with an aluminum checker plate cover and permanently fastened to the floor.
- .3 If the sump pump is located in the machine room and within 1 metre of any electrical equipment it must be provided with a rubber dielectric cover for the access hatch.

End of Section

16.0 Approved Elevator Manufacturer

- .1 Approved manufacturers are as follows:
 - i. Kone
 - ii. ThyssenKrupp
 - iii. Otis
 - iv. Global Tardif
 - v. AVT Beckett
 - vi. Ascenseur Design
- .2 Approved control manufacturers are as follows:
 - i. GAL
- .3 Approved fixture manufacturers are as follows:
 - i. Dupar

End of Section

Division 21 – Fire Suppression

All new construction and renovation projects on Carleton University campuses are required to meet the Carleton University Facilities Design Guidelines. Including from the initial planning and design stages through to the various phases of construction and facilities maintenance and management. They are to mirror planning, design, construction, maintenance, and other facilities supporting University personnel. These documents are to be used as a guideline only on all Carleton University projects and are not to be used for bidding, permitting construction, or any other purpose. Any changes or substitutions must be approved by Carleton University Facilities Management and Planning (CUFMP) and must be submitted in writing. This document is the property of Carleton University. Any use of this document, in part or in whole, for purposes other than a Carleton University project cannot be done without written permission from the University.

Table of Contents

21 08 00 - Commissioning of Fire Suppression	3
21 13 16 - Dry Pipe Sprinkler Systems	5
21 13 16.13 - Carbon Dioxide Fire Extinguishing Equipment: Total Flooding.....	6
21 21 16.16 - Carbon Dioxide Fire Extinguishing Equipment: Local Application	6
21 22 00 - Clean Agent Fire Extinguishing Systems	6
21 23 00 - Wet Chemical Fire Extinguishing Systems	6
21 24 00 - Dry Chemical Fire Extinguishing Systems.....	6
21 30 00 - Fire Pumps	6

21 08 00 - Commissioning of Fire Suppression

Commissioning Package

Submit the following:

- Commissioning Plan
- Commissioning Procedures
- Certificate of Readiness
- Complete Test Sheets
- Source Quality Control Inspection and Test Results Commissioning Closeout Package Should Include the Following
- Deficiency Report
- Commissioning Closeout Report

Submit the following for each product for incorporation into the Operation and Maintenance Manuals

- Identification: Manufacturer's name, type, year, serial number, number of units, capacity, and identification to related systems; Functional description detailing operation and control of components; Performance criteria and maintenance data; Safety precautions; Operating instructions and precautions; Component/parts availability, including names and addresses of spare part suppliers; Maintenance and troubleshooting guidelines/protocol; Product storage, preparation, handling, and installation requirements; Commissioning report.

Products:

Pipe, Fittings, and Joints:

Pipe, fittings and joints are to be as follows:

- PVC: Class 200, DR14, rigid hub and spigot pattern PVC pipe and CSA certified fittings to CAN/CSA B137.2 and B137.3, complete with gasketed joints.
- Schedule 40 Steel - Grooved Coupling Joints: Schedule 40 mild black carbon steel, ASTM A53, Grade B, complete with fittings and couplings - Victaulic "FireLock" fittings and Victaulic Style 009N, 107H, and 107N QuickVic and 005 rigid coupling joints, or approved equivalents. Strap-on fittings such as Victaulic "Snap-Let" or similar strap type fittings are not acceptable.
- Victaulic Standard Mechanical Couplings: Manufactured in two segments of cast ductile iron, conforming to ASTM A-536, Grade 65-45-12. Gaskets are to be pressure-responsive synthetic rubber, grade to suit intended service, conforming to ASTM D-2000. Mechanical coupling bolts are to be zinc plated (ASTM B-633) heat treated carbon steel track head conforming to ASTM A-449 and ASTM A-183. Couplings are to comply with ASTM F1476, Standard Specification for Performance of Gasketed Mechanical Couplings for Use in Piping Applications.
- Rigid Type: Coupling housings with offsetting, angle-pattern bolt pads are to be used to provide system rigidity and support and hanging in accordance NFPA-13. Couplings are

to be fully installed at visual pad-to-pad offset contact. Couplings that require exact gapping of bolt pads at specific torque ratings are not permitted.

- Flexible Type: Use in locations where vibration attenuation and stress relief are required. Victaulic Style 177 (Quick-Vic™), flexible coupling or approved equivalent.
- Schedule 40 Steel - Screwed and Welded Joints: Schedule 40 mild black carbon steel, ASTM A53, Grade B. Screwed piping is to be complete with Class 125 cast iron screwed fittings to ANSI/ASME B16.4. Welded piping is to be complete with factory made seamless carbon steel butt welding fittings to ASTM A234, Grade WPB, long sweep pattern wherever possible.

Shut-off Valves:

- Minimum 2070 kPa (300 psi) rated full port brass or bronze body screwed ball valves and lug body or grooved end type butterfly valves.
- Butterfly valves are to include a pressure responsive seat, and stem is to be offset from disc centerline to provide complete 360° circumferential seating.
- Standard of Acceptance: Victaulic Style 705 or approved equivalent.
- Supervised closed applications standard of acceptance Victaulic Series 707C supervised closed butterfly valve or approved equivalent.
- OS&Y Gate Valves or approved equivalent: 1725 kPa (250 psi), grooved ends, ductile iron body, yoke, and handwheel conforming to ASTM A-536, EPDM coated.
- ASTM A-126-B cast iron disc, ASTM B16 brass rising stem, flanged and epoxy coated ductile iron bonnet, EPDM O-ring stem seals and body gasket. Victaulic Series 771H (Grooved ends) and Series 771F (Grooved x Flanged), or approved equivalent.

Check Valves:

- Minimum 1725 kPa (250 psi) resilient seat check valves suitable for vertical or horizontal installations. Standard of Acceptance: Victaulic Series 717 or approved equivalent.
- Check valves associated with Fire Department connection(s) and fire pump test connection are to be tapped for site installation of a 20 mm (¾") dia. ball drip.

Ball Drips:

- National Fire Equipment Ltd. Model #58-2 or approved equivalent, 20 mm (¾") diameter automatic ball drip.

Shut-off Valves Supervisory Switches

- Tamper-proof supervisory switches, each arranged to activate a fire alarm system trouble alarm condition if the valve is closed or tampered with, each suitable in all respects for the application, and each complete with required mounting and connection hardware.
- Actuator housings are to be weatherproof.

Fire Department Connection

- Wall mounting polished brass clapper type dual inlet fire department connection with 2, 65 mm (2-½") diameter inlets threaded to fire department hose requirements and equipped with caps and chains and a faceplate.
- Faceplate is to be polished brass and complete with "STANDPIPE", "SPRINKLER" or "SPRINKLER/FIRE OR PUMP TEST HEADER" cast-in raised lettering.
- Exposed metal parts of fire department connection are to be chrome plated.
- For low point near each fire department connection, 90° elbow with drain connection to allow for system drainage to prevent freezing. Standard of acceptance: Victaulic #10-DR or approved equivalent.

Fire Protection Main "Loss of Pressure" Alarm Sensor

- Piping mounted adjustable pressure sensor designed to actuate an alarm upon sensing a loss of pressure in fire protection main. Switch is to be low voltage or line voltage as required.

End of Section

21 13 16 - Dry Pipe Sprinkler Systems

Dry Pipe Zone Valve

Victaulic Series 768-NXT or approved equivalent:

- Series 746-LPA accelerator quick opening device;
- Series 757 regulated air maintenance trim assembly;
- Required air pressure: (90 kPa) 13 psig;
- Externally resettable valve.
- Series 757 regulated air maintenance trim assembly.
- Provide valve complete with internal components that are replaceable without removing valve from installed position.
- Systems requiring a quick opening device are to use a regulated, tank-mounted air supply.

Dry Pipe Zone Air Compressor

- NFPA listed, CSA certified, oil-less, piston type direct driven compressor with a motor conforming to requirements specified in NFPA 13.
- General Air Products OLT Series or approved equivalent, package type, oil-free, piston type, tank mounted air compressor set complete with a horizontal ASME rated and stamped steel tank with support feet, pressure gauge with gauge cock, tank drain, flexible compressor to tank and tank to piping flexible connections supplied loose for field installation.

End of Section

21 13 16.13 - Carbon Dioxide Fire Extinguishing Equipment: Total Flooding

- Should be installed in accordance with NFPA 12.

End of Section

21 21 16.16 - Carbon Dioxide Fire Extinguishing Equipment: Local Application

- Should be installed in accordance with NFPA 12.

End of Section

21 22 00 - Clean Agent Fire Extinguishing Systems

- Should be installed in accordance with NFPA 2001.

End of Section

21 23 00 - Wet Chemical Fire Extinguishing Systems

- Should be installed in accordance with NFPA 17A.

End of Section

21 24 00 - Dry Chemical Fire Extinguishing Systems

- Should be installed in accordance with NFPA 17.

End of Section

21 30 00 - Fire Pumps

- Design systems to avoid the need for a fire pump. Specify a fire pump only where the system cannot reasonably be designed without one and only after consulting with FMP.
- Where a fire pump is provided include a metered bypass for testing the fire pump and installation of test header according to NFPA 20 for flow testing.

End of Section

Division 22 – Plumbing

All new construction and renovation projects on Carleton University campuses are required to meet the Carleton University Facilities Design Guidelines. Including from the initial planning and design stages through to the various phases of construction and facilities maintenance and management. They are to mirror planning, design, construction, maintenance, and other facilities supporting University personnel. These documents are to be used as a guideline only on all Carleton University projects and are not to be used for bidding, permitting construction, or any other purpose. Any changes or substitutions must be approved by Carleton University Facilities Management and Planning (CUFMP) and must be submitted in writing. This document is the property of Carleton University. Any use of this document, in part or in whole, for purposes other than a Carleton University project cannot be done without written permission from the University.

Table of Contents

22 00 00 – General Works.....	3
22 13 00 – Pipe Hangers and Supports	6
22 14 00 – Thermometers and Pressure Gauges.....	7
Mechanical Identification	8
22 42 01 – Plumbing Fixtures.....	12
22 42 02 – Piping.....	17
22 45 00 – Plumbing Equipment.....	20

22 00 00 – General Works

General

Design Criteria and Notes:

- Design Consultants shall develop reliable and innovative solutions to facilitate design requirements.
- Periodic design progress reviews and system evaluations and recommendations must be scheduled with Facilities Management and Planning (FMP) for acceptability.
- Consultants are required to submit a report identifying all building systems intended for inclusion within the facility design, their function and relationship to each other with regard to centralized control and monitoring, effective maintenance, and provisions for future expansion and sustainable operations.

Design Brief:

As early as possible in the design stage, FMP shall be provided with a design brief for mechanical design regarding the proposed mechanical system, including provisions for future expansion, sustainability criteria, and economic analysis of system selection, effective maintenance, and data that would be of value to operating personnel. The consultant must follow the Carleton University project procedure for TSSA.

As-Built Drawings:

The Consultant is responsible for the quality of shop drawings, as-built drawings, and maintenance manuals (see General Conditions of Contract and Prime Consultant Agreement). This information is of great value to the University, and every effort shall be made to ensure that complete and accurate information is provided by the Contractor and equipment suppliers and is sufficiently detailed for the project to be effectively implemented and for ongoing maintenance and operation.

Mechanical Drawings:

Mechanical drawings shall be sufficiently detailed to ensure that the project can be effectively implemented, and incorporates schematics as follows.

Green Globe Certification:

Work with FMP through design evaluation workshops and review meetings to develop the sustainable design strategies for the project and complete the design and construction level worksheets.

Complete piping showing:

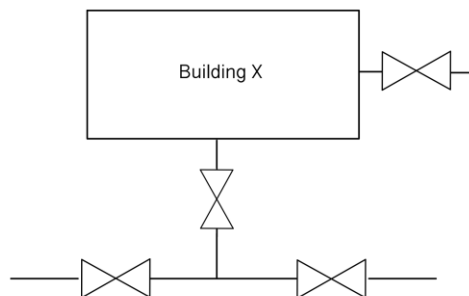
- .1 all take-offs
- .2 all valves, gauges, pressure and temperature taps, flex connectors, air vents, balancing valves
- .3 direction of flow
- .4 temperature and pressure of medium (max. and min. where variable) and pipe sizes

Division 22 – Plumbing

- .5 pump characteristics:
 - .1 head
 - .2 flow in gallons
- .6 control valves characteristics:
 - .1 type of control valve
 - .2 flow in gallons
- .7 heat exchanger characteristics:
 - .1 pressure loss (design)
 - .2 capacity (GPM #/hr. steam high temp. and med. temp. water)
 - .3 differential temperature
- .8 steam trap characteristics:
 - .1 capacity
 - .2 type
- .9 coil characteristics:
 - .1 quantity GPM
 - .2 head loss water side
 - .3 number of rows and type of flow, i.e. counter or parallel

Complete plumbing systems showing:

- .1 all take-offs labelled in correct sequence
- .2 complete venting system
- .3 pipe sizes and fixture units
- .4 isolation valves
- .5 Provide a minimum of three isolation valves to allow alternative usage in case the water main shuts down. Where possible, provide a second service branching off from the building.



Complete systems of all other miscellaneous and auxiliary systems showing:

- .1 take-offs labelled in correct sequence
- .2 all components and their characteristics
- .3 all line sizes and flow capacities
- .4 all systems drops or losses where such affects design or operation

.5 complete list of flow quantities designed into systems for future expansion

.1 Specialty Pipes and Pipe Fittings:

All domestic hot water, cold water and recirculation branches must contain isolation valves per floor.

.2 Domestic hot water supply:

Type L copper is recommended for domestic hot water supply piping. Synthetic piping is not acceptable.

.3 Corrosive resistant and special waste piping system:

.1 A separate system shall be installed for handling corrosive waste.

.2 The piping should be readily accessible for sectional replacement.

.3 This refers primarily to laboratory and acid wastes. For building piping, consult with FMP.

.4 Water hammer suppression – isolatable for service/replacement.

End of Section

22 13 00 – Pipe Hangers and Supports

- .1 All piping hangers will be clevis type, when expansion is an issue, then roller hangers are to be installed.
- .2 There is to be 1/8" thick by 4" wide rubber pad between hanger and piping.
- .3 Pipe hangers shall not be suspended by insulation nor shall pipes compress insulation between pipe and hangar.

Pumps

- .1 Pumps in closed systems should be equipped with mechanical seals to minimize leakage.
- .2 Provide gland cooling for water systems over 180°F (82°C).
- .3 Use braded stainless steel flexible pump connectors where needed.
- .4 Piping to the pumps shall be adequately supported from the structure eliminate stresses on the pump.
- .5 Provide 100% backup for systems circulation pumps of heating
- .6 Pumps should be direct drive where possible.
- .7 Provide gauges/gauge ports across pumps. All monitoring points must have a gauge. To allow for additional port (s) for pressure transducers, etc. there should be a tee-line installed with a valve on the line to allow for multiple connections if desired.
- .8 Provide a duplex system of fine mesh filters/strainers upstream of the pumps, complete with isolating valves.
- .9 Pumps used for continuous operation that have motors greater than 5Hp to be considered for Variable Speed Drives.
- .10 Pumps to be Armstrong, Grundfoss, Bell and Gossett, or Myers.

Valves

- .1 Ball valves in sizes 1½ through 6" (40 mm through 150 mm) to be designed for minimum 125 psig (WOG) bubble-tight working pressures. Valve seals shall be designed for 450°F (232°C) maximum temperature.
- .2 All butterfly valves 6" through 12" (150 mm through 300 mm) to have manual gear operators. Valve bodies shall be of one-piece design, zinc electroplated in accordance with ASTM A-164, and cast of ductile iron conforming to ASTM A-536 or malleable iron conforming to ASTM A-47. Valve discs to be of ductile iron conforming to ASTM A-536, 65-45-12 and plated with nickel chromium. Valve operator hubs to be cast of malleable iron conforming to ASTM A-47. Infinitely variable, extending lever handles shall be electroplated carbon steel.

End of Section

22 14 00 – Thermometers and Pressure Gauges

- .1 Gauges are to be used across pumps. All gauges are to be provided with shut-off valves.
- .2 Thermometers are to be installed in wells. Bottom of well is to be 1/3 inside the pipe and is to be stainless steel. All gauges and thermometers must be easily removable and readable. Standard ranges for thermometers to be: chilled water 0 – 30°C, condenser water 0 – 50°C, all other services 0 – 110°C
- .3 Domestic water pressure gauge is to be located at the entry to the building main mechanical room or after the building isolation valve.

End of Section

Mechanical Identification

1. All piping and equipment in exposed locations such as equipment rooms, pipe service chases, ceiling spaces, etc., shall be clearly labelled and identified to reflect ANSI/ASME colour coded installation guide and sizing. Refer to Figure 3.
2. For pipes over 3" in diameter and all ducts, the lettering shall be 2" high.
3. Each label and arrow shall be further held in place by a banding tape at each end, of the same colour as the label background, and of width equal to the lettering height.
4. Markers to be Brady All-Temperature B-350 Perma-Code, or B-500 vinyl cloth or approved alternate.
5. Identification shall be applied where view is not obstructed. Apply at each valve and where pipes leave or enter a room. Also apply no more than 25 feet apart on long runs. Where label will not stick to a surface, wrap with PVC pipe wrap and apply label to it.

6. For piping identification, conform to the following:

Pipe Marker Legend	Valve Tag Legend	Primary Colour	Secondary
Cold Water	CW	green (light)	none
Chilled Water Supply	CHWS	green (dark)	none
Chilled Water Return	CHWR	green (dark)	none
Dom. Hot Water Supply	DHWS	green (light)	none
Dom. Hot Water Recirc	DHWR	green (light)	none
Hot Water Heating Supply up to 120°C Glycol	HWS GL	yellow	black
Hot Water Heating Return up to 120°C	HWR	yellow	black
Steam Condenser Return	Steam, kpa CR	yellow yellow	black black
Adm. Sewer	SANS	green (dark)	none
Engine Exhaust	EE	yellow	black
Compressed Air Gauge Pressure 120 psi and lower	CA, kpa	green (dark)	none
Fire Protection Water	ZPW	red	white
Sprinkler Water	SW	red	white
Vent (plumbing)	VP	green (dark)	none
Liquid Nitrogen	LN		
Distilled Water	DW		
Natural Gas	NG	yellow	

1. Conform to colours coding schedule CGCB 1-GP-12c. Classifying colours and markers to be easily seen from floor. Identify both sides when piping passes through walls or floors. Identify piping at start and end points and at major manual and automatic valves. See Figure 3.
2. For identification of ductwork use 2" high black stencilled letters easily seen from floor. Provide markers on underside of suspended ceiling to locate boxes.
3. For identification of valves and controllers use laminated plastic tags with ¾" engraved lettering. Provide flow diagrams and mount in mechanical room and place copy in maintenance manual.

MECHANICAL SOUND, VIBRATION AND CONTROL

1. Use ASHRAE guide for determining the recommended noise level limits and NC curves. Select mechanical equipment that will not produce noise and vibration beyond the recommended noise criteria for the space under consideration.
2. All equipment subject to vibration shall be adequately supported on isolation devices to limit transmission of vibration to an acceptable level. The following charts can be used as a general guide to transmission efficiencies, in permanent transmission.

Centrifugal Fans

RPM	400	600	800	1000	1200	1500	2000
Basement	10	6	5	4	4	4	3
Penthouse	4	3	2	2	2	2	2

Air Compressors, Vacuum Pumps

RPM	400	600	800	1000	1200	1500	2000
Basement	10	6	5	4	4	3	3
Penthouse	4	3	2	2	2	2	1

Axial Fans

RPM	400	600	800	1000	1200	1500	2000
Basement (ceiling-mounted)	10	6	5	4	4	3	2
Penthouse	4	2.5	2	2	1.5	1.5	1.5

PIPING INSULATION

1. Insulate the following:
 1. heating water and glycol supply and return piping and fittings
 2. refrigerant suction gas pipes
 3. steam and condensate piping and fittings
 4. chilled water
 5. domestic hot water
 6. domestic cold water
 7. plate exchangers
 8. rain leader/roof hoppers
 9. heating oil piping (CHP)
2. Insulate control valves with properly designed removable insulation.
3. Provide PVC surface finish, suitable for painting, to all exposed surfaces.
4. Piping insulation thickness should comply with current ASHRAE Standard 90.
5. Provide removable insulation on fittings, valves and end caps. Removable aluminum cans (Pittsburgh) fastened with screws on all fittings, valves and end caps. On oversized piping gored elbows shall be used.
6. Steam equipment and piping:
 1. 4" Roxul mineral fiber
 2. equipment inside building – aluminium embossed 16 ga. (removable)
 3. exterior equipment – aluminium embossed 16 ga.
 4. tank ends – segmented and profiled for personnel protection (Pittsburgh fittings – rounded edges)
 5. mitered joint on 3" + piping system
 6. all fittings are removable for service (valves, mitres, etc.)
 7. all equipment and piping in Central Heating Plant and campus to be covered with embossed aluminium 16 ga
7. Steam condensate piping:
 1. 2" Roxul mineral fiber
 2. equipment inside building – aluminium embossed 16 ga. (removable)
 3. exterior equipment – aluminium embossed 16 ga.
 4. tank ends – segmented and profiled for personnel protection (Pittsburgh fittings–rounded edges)
 5. mitered joint on 3" + piping system
 6. all fittings are removable for service
8. Steam condensate piping:
 1. 2" Roxul mineral fiber
 2. equipment inside building – PVC wrap (removable)
 3. exterior equipment – aluminium embossed 16 ga.

Division 22 – Plumbing

4. tank ends – segmented and profiled for personnel protection (Pittsburgh fittings–rounded edges)
5. mitered joint on 3" + piping system
6. all fittings are removable for service

9. Chilled water system:

1. 2" Roxul mineral fiber
2. equipment inside building – PVC wrap (removable)
3. exterior equipment – aluminium embossed 16 ga.
4. tank ends – segmented and profiled for personnel protection (Pittsburgh fittings–rounded edges)
5. mitered joint on 3" + piping system
6. all fittings are removable for service

10. Oil line:

1. armor glass insulation and embossed aluminium cover 16 ga.

PLUMBING SPECIALTIES

1. Lawn Service:

1. One wall hose bib shall be provided on each elevation or one wall hose bib between each set of exterior doors, whichever provides the greater number of hose bibs.
2. Wall hose bibs shall be positioned not more than 36 inches or less than 30 inches vertically above the finished grade.
3. Recommend surface mounted or recessed wall hose bibs manufactured by Zurn Industries Ltd. or approved alternate as follows:
 - i. Encased Non-Freeze wall hydrant with integral vacuum breaker, product # ZN-1303
 - ii. Exposed Non-Freeze wall hydrant with integral vacuum breaker, product # ZN-1313

End of Section

22 42 01 – Plumbing Fixtures

General

Design Criteria and Notes:

- .1 Low voltage transformers shall be located in an accessible space, hardwired to electrical circuit, plug-in transformer is not recommended for public space.
- .2 Ensure that the drainage for low flush water closets must be of proper material to handle the undiluted waste due to low water consumption.

Products

Water Closets

With the following characteristics:

- .1 All water closets must be white
- .2 It is preferred that water closets in public areas must be wall hung on chair carrier
- .3 All water closet seats in public washrooms must be white solid plastic, open front, without cover
- .4 Use of water saving water-closet is required
- .5 Low flow toilets models should not use more than 4.8 litres per flush. (manual flush)

Manual lever operated Water Closet Flush Valve

With the following characteristics:

- .1 Exposed flush valve with manual lever.
 - .2 High efficiency (1.28gpf/4.8Lpf).
 - .3 Chloramine resistant diaphragm.
 - .4 Brass construction with Polished chrome plated finish.
 - .5 1" IPS Screwdriver Back-check angle stop.
 - .6 Vandal resistant stop cap.
 - .7 Chrome plated vacuum breaker tube.
 - .8 Spud coupling and flange for 1-1/2" top spud.
 - .9 Trap primer connection to flush valve shall be considered where new floor drain is required.
 - .10 ADA & ASSE1037 compliant.
- Suggested (or equivalent) Products:
- .1 "111-1.28" by SLOAN (Manual Lever).
 - .2 "81T201-48", by DELTA (Manual Lever).

Sensor activated Water Closet Flush valve

With the following characteristics:

- .1 Exposed hardwired flush valve with integral solenoid (concealed flush valve is not allowed).
- .2 High efficiency (1.28gpf/4.8Lpf).
- .3 Brass construction with polished chrome plated finish.
- .4 Chloramine resistant diaphragm.
- .5 1" IPS Screwdriver Back-check angle stop.
- .6 Vandal resistant stop cap.
- .7 Chrome plated vacuum breaker tube (concealed vacuum breaker is not allowed).
- .8 Spud coupling and flange for 1-1/2" top spud.
- .9 Chrome plated wire covering tube.
- .10 Hardwired infrared sensor, to be recessed in wall.
- .11 Valve top mounted infrared sensor also acceptable.
- .12 Sensor range shall be field adjustable.
- .13 Electronic manual override button or true mechanical override.
- .14 Vandal resistant chrome plated or stainless steel cover plates with vandal resistant screws (cover plates using hidden/invisible fastener such as set screws are not acceptable).
- .15 Trap primer connection to flush valve shall be considered where new floor drain is required.
- .16 ADA & ASSE1037 compliant.
- Suggested (or equivalent) Products:
 - .1 "111-1.28 ES-S Optima" by SLOAN or (Wall Mounted Sensor with Override Button).
 - .2 "81T201-48-WMSHWA" by DELTA (Wall Mounted Sensor with Override Button).
 - .3 "81T201-48-HWA" by DELTA (Valve Top Mounted Sensor with Override Button).

Water Closet Seat

With the following characteristics:

- .1 Commercial high strength impact resistant thermoplastic.
- .2 Heavy duty.
- .3 Corrosion free hardware.
- .4 Open front elongated bowl seat, without cover.
- .5 Stainless steel check hinges, nuts and lock washers.
- .6 Withstanding strong chemicals.

- .7 Color: White.

Urinals

With the following characteristics:

- .1 Washout wall hung urinal with integral extended shields.
- .2 When replacing or installing new low flush urinals, all drainage and fittings to mains must be in fire rated PVC (XFR) or equivalent.
- .3 Ultra-High efficiency, Low consumption.
- .4 Vitreous china.
- .5 Top inlet spud (3/4" diam.) (Back spud - conceal application - is not acceptable).
- .6 Color: White.
- .7 ADA Compliant.
- Suggested (or equivalent) Products:
 - .1 "6590.001" by American Standard.
 - .2 "Z5758", by ZURN.

Manual lever operated Urinal flush valve

With the following characteristics:

- .1 Exposed flush valve with manual lever.
- .2 High efficiency (0.125 gpf/0.5 Lpf).
- .3 Chloramine resistant diaphragm.
- .4 Brass construction with Polished chrome plated finish.
- .5 3/4" IPS Screwdriver Back-check angle stop.
- .6 Vandal resistant stop cap.
- .7 Chrome plated vacuum breaker tube.
- .8 Spud coupling and flange for 3/4" top spud.
- .9 Trap primer connection to flush valve shall be considered where new floor drain is required.
- Suggested (or equivalent) Products:
 - .1 "186-0.125 DBP" by SLOAN (Manual Lever)
 - .2 "81T231-05", by DELTA (Manual Lever)

Sensor activated Urinal flush valve

With the following characteristics:

- .1 Exposed hardwired flush valve with integral solenoid (concealed flush valve is not allowed).

- .2 High efficiency (0.125 gpf/0.5 Lpf).
- .3 Brass construction with Polished chrome plated finish.
- .4 Chloramine resistant diaphragm.
- .5 3/4" IPS Screwdriver Back-check angle stop.
- .6 Vandal resistant stop cap.
- .7 Chrome plated Vacuum breaker tube (concealed vacuum breaker is not allowed).
- .8 Spud coupling and flange for 3/4" top spud.
- .9 Chrome plated wire covering tube.
- .10 Hardwired infrared sensor, to be recessed in wall.
- .11 Valve top mounted infrared sensor is also acceptable.
- .12 Sensor range shall be field adjustable.
- .13 No manual override button for urinals.
- .14 Vandal resistant chrome plated or stainless steel cover plates with vandal resistant screws (cover plates using hidden/invisible fastener such as set screws are not acceptable).
- .15 Trap primer connection to flush valve shall be considered where new floor drain is required.
- .16 ADA & ASSE1037 compliant.
- Suggested (or equivalent) Products:
 - .1 "186-0.125 DBP ESS Optima" by SLOAN or (Wall Mounted Sensor).
 - .2 "81T231-05-WMSHWA" by DELTA (Wall Mounted Sensor).
 - .3 "81T231HWA-05" by DELTA (Valve Top Mounted Sensor).

Faucets/Lavatories

Vanity mounted lavatories are preferred.

Low flow faucets:

With the following characteristics:

- .1 In public washrooms individual electronic automatic sensors should be used for the faucets and flow should be limited to not more than 2 litres per minute. There should be at least one manually operated faucet in all public washrooms.
- .2 Private washrooms (for example in residences) may have manual taps but must also be restricted to a flow rate of not more than 2 litres per minute.
- .3 Faucets in residence laundry areas and in labs should also have aerators or restrictors to reduce flow to a maximum of

2 litres per minute.

- .4 *** Labs or other areas requiring exceptions to this rule must be approved by an FMP.

Drinking Fountains

1. Drinking fountains shall be Wall Hung Stainless Steel, without Cooler
2. Drinking fountains shall be wall mounted, stainless steel, 16 gauge (1.5mm) with #4 satin finish, 14" dia. (356mm) receptors, lead free, 'Soft Touch Valve' Cast brass control bubblers, self- closing, automatic volume regulators, vandal-resistant open grid strainer, Tailpiece, heavy duty Mounting Plate with S.S cover plate. McGuire #HST11BV Supplies, with straight ball valve stops.
3. McGuire #8872C 'p' Traps, C.P. cast brass 1-1/4" (32mm) with cleanouts (concealed in wall). Smith Series #0824 Carrier, with steel pipe legs, block base feet support and double length plate.
4. Standard of Acceptance: Filtrine #107-14WC-STV-CP, Haws.
5. Drinking fountains must include a water bottle filling station, as per below;
6. Water Bottle Filling Stations:
7. Water bottle filling stations shall be:
8. Elkay EZH20
9. Non-refrigerated
10. Non-filtered

Washroom Floor Drains:

1. Each washroom shall have at least one (1) floor drain complete with trap seal primer.

Washroom Hose Bib:

1. A cold supply hose bib, key-operated, shall be provided in each public washroom, located such that the hose bib is convenient for custodial personnel, but as inconspicuous as possible. The supply shall be provided with a shut-off cock.

End of Section

22 42 02 – Piping

General

Design Criteria and Notes:

- .1 Piping Systems:
 - .1 Hydronic piping to be steel pipe to ASTM A53 Grade B:-1 to 6" (150 mm), Schedule 40, 8" to 10" (200 mm to 250mm), Schedule 30, 12" (300 mm) and over, 3/8" (10 mm) wall thickness or copper tube piping, hard drawn, type L to ASTM B88M-99.
 - .2 Drainage piping to be:
 - .1 For Urinals, laboratories or any other dealing with high corrosive materials: Shall have high chemical corrosive resistance, such as Polypropylene - with either fused sockets or proprietary mechanical joints, or Polyvinylidene Fluoride (PVDF) - with polyfusion joint or solvent bonding.
 - .2 For vestibules entrances dealing with salty conditions, or where the pipes are penetrating fire separation: Uncoated PVC Rated with, appropriate fire-sealing around the penetrations.
- .2 Layout- Vertical piping chase:
 - .1 On each floor, access to vertical piping chase shall be made easy by means of access doors.
 - .2 Piping should be layout in a manner that future connections will be easy to make.
 - .3 Shut off valve should be located on each floor.
- .3 Pure water piping:
 - .1 Pure water piping system shall be design and installed with a recirculation loop.
 - .2 Pure water piping shall be new, unpigmented Polypropylene to schedule 80, IPS dimensions. Joints shall be shock welded or Rionite mechanical joints.

Distilled/Deionized Water Systems

- .1 Consideration shall be given to limiting outlets to one per laboratory. Consult with FMP for Verification
- .2 Dechlorination prior to distillation may be required at some locations. Consult with FMP for verification
- .3 Distilled water may be conveyed via the following:
 - .1 Pure polypropylene pipe using proper fittings and connectors. This is the recommended piping system for distilled, deionized, or demineralized water distribution. High density polyethylene pipe using proper fittings and connectors.

- .2 Teflon with the proper fittings and connectors.
- .3 Nylon with the proper fittings and connectors. Expansion is a serious problem.
- .4 Polyethylene with the proper fittings and connectors. This material has a low softening point – 40°C. Care must be taken when selecting the bonding solvent.
- .5 Polypropylene with the proper fittings and connectors. Fillers in the polypropylene shall be as little as possible
- .6 Plastics other than the aforementioned are not recommended.

Localized Stills

- For high quality distilled water, localized stills are recommended over high quality distribution from a central source.

Vacuum

- .1 Water aspirators are not allowed.
- .2 Vacuum piping may be required at some locations. Consult with FMP for verification

Clean-out

- For sanitary equipment, sewer clean-out to be installed above rim level, in order to prevent the rejection of waste during cleaning process.

Products

- .1 Floor Drain: Floor drain with round bronze strainer, cast iron, 4" throat, and reversible membrane clamp.
 - Suggested (or equivalent) Product: "FD-100-C-A" by Watts
- .2 Area Drain: Epoxy coated cast iron, 8"x8", adjustable top, standard outlet c/w body collar with weep holes and anchor flanges.
 - Suggested (or equivalent) Product: "FD-330" by Watts
- .3 Trap Seal Primer (for Washroom/kitchen Area Drains): To be provided with Flush Valve TrapSeal Primer. In location where it is impossible or too costly to connect the drain with a Flush Valve Trap Seal Primer, a Trap Guard seal may be used instead.
 - Suggested (or equivalent) Product:
 - .1 "MI-702" by MiFab
 - .2 "VBF-72-A1" by Sloan
- .4 Polypropylene piping: Schedule 40, certified to CAN/CSA B1800-02.
 - Suggested (or equivalent) Product:
 - .1 "Blueline" by Orion

- .5 Polyvinylidene Fluoride (PVDF) piping:
 - Suggested (or equivalent) Product: “Pegas Superblue” by Corix

- .6 Uncoated PVC Rated: Made of tough, impact resistant PVC, high moisture, salts, soils and acid resistant. With fire-retardant properties that eliminate flame spread and reduce the volume of smoke generated. To apply with related fire stopping products.
 - Suggested (or equivalent) Product: “System 15 XFR ” by IPEX

End of Section

22 45 00 – Plumbing Equipment

Domestic Hot Water

- .1 Provide necessary controls to turn system off during unoccupied hours. Shut-off shall include heating source as well as recirculation systems
- .2 Provide thermostatic control to domestic hot water circulating pumps to maintain water at 38° C in the re-circulating loop if required
- .3 Where special functions, such as dishwashing, require hotter water, provide a local booster heater rather than heat all water in the building to meet localized requirements
- .4 Domestic hot water temperature will be monitored by the Building Automation System
- .5 Instantaneous hot water heater shall be Leslie or Armstrong

General Lavatories and Sinks

- .1 Vanity mounted lavatories are preferred.
- .2 Low flow faucets:
- .3 In public washrooms individual electronic automatic sensors should be used for the faucets and flow should be limited to not more than 2 litres per minute. There should be at least one manually operated High Arc Spout faucet in all public washrooms.
- .4 Private washrooms (for example in residences) may have manual taps but must also be restricted to a flow rate of not more than 2 litres per minute.
- .5 Faucets in residence laundry areas and in labs should also have aerators or restrictors to reduce flow to a maximum of 2 litres per minute.
***Labs or other areas requiring exceptions to this rule must be approved by an FMP.
- .6 Slop Sink: Terrazzo 6" drop front slop sink, 36"x36"x12", c/w Stainless Steel caps and drain.
Trim to be service-sink faucet.
- Suggested (or equivalent) Product: "TSB 3002" by Crane & "830-AA" by Fiat.
-- .7 Kitchen Sink: Size as per design parameters, with the following characteristics:
 - .1 In Stainless steel, type 304 (18/10), No. 4 satin finished.
 - .2 Single compartment, self-rimming drop sink with faucet ledge.
 - .3 Material thickness: 18 gauge (1.2 mm).
 - .4 No overflow.
 - .5 One Faucet hole.
 - .6 Undercoated to reduce condensation and resonance.

- .7 3 ½" cup strainer.
 - .8 1 ½" brass tailpiece.
 - Suggested (or equivalent) product: "LBS6808P-1" by Franke.
- .6 Faucet Kitchen Sink: With the following characteristics:
- .1 Single hole, single lever.
 - .2 Chrome plated.
 - .3 9 ½" center to center integral cast brass spout.
 - .4 1.5 GPM (5.7 L/s) max., non-aerating outlet.
 - .5 Ceramic Cartridge.
 - .6 User adjustable temperature control mixer.
 - .7 Temperature limiter.
 - .8 Rated operating pressure: 20-125 psi.
 - .9 Rated operating temperature: 40-140°F.
 - .10 ADA compliant.
 - Suggested (or equivalent) product: "430-ABCP" by Chicago Faucets.
- .7 Water Fountains: With the following characteristics:
- .1 Drinking fountains shall be Wall Hung Stainless Steel, without Cooler
 - .2 Drinking fountains shall be wall mounted, stainless steel, 16 gauge (1.5mm) with #4 satin finish, 14" dia. (356mm) receptors, lead free, 'Soft Touch Valve' Cast brass control bubblers, self-closing, automatic volume regulators, vandal-resistant open grid strainer, Tailpiece, heavy duty Mounting Plate with S.S cover plate. McGuire #HST11BV Supplies, with straight ball valve stops.
 - .3 McGuire #8872C 'p' Traps, C.P. cast brass 1-1/4" (32mm) with cleanouts (concealed in wall). Smith Series #0824 Carrier, with steel pipe legs, block base feet support and double length plate. Standard of Acceptance: Filtrine #107-14WC-STV-CP, Haws.
 - .4 Drinking fountains must include a water bottle filling station, as per below;
 - .5 Water Bottle Filling Stations:
 - .6 Water bottle filling stations shall be:
 - a. Elkay EZH20
 - b. Non-refrigerated
 - c. Non-filtered

Laboratory Fixtures, & Sinks

General

- Equip sinks and with tailpieces, cross strainer, plug and removable overflow. Standing removable overflow, when in position, should be 25 mm (1") below flood level of sink. Include perforated overflow guard with top 12.7 (1/2") below flood level.

.1 Laboratory Sinks:

.1 Stainless Steel Sinks:

- .1 Shall be of 1.2 mm (18 Ga.) thickness overall, seamless, drawn in one piece with rounded edges and corners.
- .2 Integrated sinks within the counters must be fabricated with the same Stainless Steel as the counters, with integrated drainboards if indicated.
- .3 Drainage connections shall be in non-corrosive materials.

.2 Epoxy Resin Sinks: Shall be molded one piece, with 38 mm (1½") coved corners, sloped 16 mm (5/8") thick bottoms, 12.7 mm (1/2") thick walls, with corner drain and overflow, welded in place with epoxy cement, with integral epoxy drain board tops, if indicated.

- Suggested (or equivalent) product: "DropIn Sink" by Durcon.

.3 Cup Sink: Made of same gauge and Stainless Steel type as the Stainless Steel countertops, with Stainless Steel funnel (two per cup sink), or in Epoxy Resin.

.2 Laboratory Faucets:

.1 Cold water/Hot water: One hole mixer with ADA blade handles, with detachable nozzle and 200mm min. swing gooseneck and accessible wrist handles.

- Suggested (or equivalent) product: "L424-9VB" by WaterSaver.

.2 Vacuum breaker: With 200mm min. swing gooseneck.

- Suggested (or equivalent) product: "L424-9VB" by WaterSaver.

.3 Purified water faucet: Made from high purity PVDF, in either weld or sanitary clamp connections, with simple heat flaring tools for leak-proof, and minimum crevice connections between components.

- Suggested (or equivalent) product: "Georg Fischer 530" by Aquatap.

.4 Needle Valve: With inlet shank shall be of a 3/8" NPS – ¼" NPT, single, 90 degrees double, 3-way or 4-ways, as indicated.

- Suggested (or equivalent) product: "L2880-WSA" series by WaterSaver.

Emergency Fixtures

Emergency shower and eye wash

Combination shower and eye/face wash shall include:

- .1 11" (27.9 cm) Stainless steel round bowl.
- .2 Axion MSR™ eye wash head that supplies an inverted directional laminar flow which achieves zero vertical velocity supplied by an integral flow control.
- .3 Dust cover, 50 x 50 mesh water strainer.
- .4 Stay-open shower and eyewash ball valves.
- .5 Cast 9" (22.9 cm) diameter floor flange.
- .6 High visibility safety colors.
- .7 1-1/4" ips supply.
- .8 ADA & ANSI 2358.1 compliant.
- **Suggested (or equivalent) Products:**
 - .1 Surface mount:
 - "8309WC" by Haws.
 - "GBF1909" by Hadrian.
 - .2 Recessed: "8355WCC" by Haws.
- .2 **Eye/Face Wash:** Barrier-free emergency countertop mount: In Polished chrome brass single action pull-down valve body, with universal sign, 1.3 cm O.D. slip joint inlet, activated with pull- down, with full continuous flow of water, inverted directional laminar flow to sweep contaminants away from the nasal cavity, zero vertical velocity supplied by an integral flow control. C/w **Mixing Valve**.
- **CU Standard product(s):**
 - .1 Front mount: "7611" by Haws Corp.
 - .2 Back mount (shall be installed no deeper than 610mm from the front of the counter, with no interference with **Drying Racks**): "7610" by Haws Corp.

Mixing Valves

- .1 **Mixing Valve:** Thermostatic mixing valve to provide tepid water to eyewash station, 26.5 L/min., 15mm inlets & discharge, c/w cold water bypass in case of thermostatic failure, automatic spring check stops, rough brass, +/- 1.7 degree c, valve precision, temperature gauge, maximum discharge set point 29 degree c, factory set at 26 degree c, mounted in ceiling space in flush mounted box cabinet, accessible for maintenance.
 - **Suggested (or equivalent) product:** "SE-370" & "SE-376" (mounting - as applicable) by Speakman.

End of Section

Division 23 – Heating, Ventilation and Air-Conditioning

All new construction and renovation projects on Carleton University campuses are required to meet the Carleton University Facilities Design Guidelines. Including from the initial planning and design stages through to the various phases of construction and facilities maintenance and management. They are to mirror planning, design, construction, maintenance, and other facilities supporting University personnel. These documents are to be used as a guideline only on all Carleton University projects and are not to be used for bidding, permitting construction, or any other purpose. Any changes or substitutions must be approved by Carleton University Facilities Management and Planning (CUFMP) and must be submitted in writing. This document is the property of Carleton University. Any use of this document, in part or in whole, for purposes other than a Carleton University project cannot be done without written permission from the University.

Table of Contents

General.....	3
23 01 05 Operation and Maintenance of HVAC Systems During Construction	6
23 01 31 Air Duct Cleaning for HVAC Systems	6
23 05 00 Common Work Results for HVAC.....	7
23 05 13 Common Motor Requirements for HVAC Equipment.....	13
23 05 15 Common Installation Requirements for HVAC Pipework	14
23 05 16 Expansion Fittings and Loops for HVAC Piping	14
23 05 19 Meters and Gauges for HVAC Piping.....	14
23 05 19.13 Thermometers and Pressure Gauges – Piping Systems	14
23 05 29 Hangers and Supports for HVAC Piping and Equipment.....	15
23 05 33 Heat Tracing for HVAC Piping.....	15
23 05 48 Vibration and Seismic Controls for HVAC	16
23 05 48.16 Seismic Restraint Systems (SRS) – Type P2 Buildings.....	16
23 05 53 Identification for HVAC Piping and Equipment	17
23 05 92 Integrated Systems Testing	19
23 05 93 Equipment Testing, Adjusting and Balancing.....	20
23 05 93.13 Testing, Adjusting and Balancing of Fume Hoods	29
23 05 94 Pressure Testing of Ducted Air Systems.....	29
23 07 13 Duct Insulation	29
23 07 19 HVAC Piping Insulation.....	30
23 08 16 Cleaning and Start-Up of HVAC Piping Systems	32
23 21 13.03 Pressure Joint Piping Systems Hydronic Systems	33
23 21 23 Hydronic Pumps	33
23 22 16 Steam Specialties	34
23 33 00 Air Duct Accessories	35
23 33 14 Dampers – Balancing and Operation	35
23 33 16 Dampers – Fire and Smoke	36
23 37 13 Diffusers, Registers and Grilles	36
23 37 20 Louvers, Intakes and Vents	36
23 40 00 HVAC Cleaning Devices	36
23 74 00 Packaged Outdoor HVAC Equipment.....	37
23 81 23 Computer Room Air Conditioning.....	38

General

Design Criteria and Notes:

- .1 Vibration and seismic controls for HVAC piping and equipment:
 - .1 Use ASHRAE guide for determining the recommended limits and NC curves. Select mechanical equipment that will not produce noise and vibration beyond the recommended noise criteria for the space under consideration.
 2. All equipment subject to vibration shall be adequately supported on isolation devices to limit transmission of vibration to an acceptable level.
- .2 Mechanical identification
 - .1 All piping and equipment in exposed locations such as equipment rooms, pipe servicechases, ceiling spaces, etc., shall be clearly labelled and identified with flow directions indicated. For pipes over 3" in diameter and all ducts, the lettering shall be 2" high.
 - .2 Pipe labelling should be consistent with ANSI standards A13.1.
 - .3 Marking system shall be standardized with black lettering on a background colour the same as the pipe, duct, etc. for the yellow, blue and green backgrounds and white lettering on the red background. Use factory printed self-sticking labels.
 - .4 Identification shall be applied where view is not obstructed. Apply at each valve and where pipes leave or enter a room. Also apply no more than 25 feet apart on long runs. Where label will not stick to a surface, the pipe shall be wrapped continuously with the pipe tape to provide a suitable surface.
 - .5 For identification of ductwork use 2" high black stenciled letters easily seen from floor.
 - .6 Provide markers on underside of ceiling to locate boxes.
 - .7 For identification of valves and controllers use laminated plastic tags with ¾" engraved lettering.
- .3 Thermal insulation for ducting
 - .1 All air intake and exhaust ducts shall be insulated to protect building interiors from frost and moisture damage.
 - .2 Materials on the ducts should be safely secured to ductwork.
 - .3 Welded pinned Roxul board with corner beads is to be installed on all ductwork
- .4 Hydronic specialties
 - .1 Mechanical provisions to facilitate cleaning, and to ensure adequate flushing of piping systems shall be provided.
 - .2 Adequate clearances shall be provided for the removal of Tube bundles of all heatexchanges.

- .3 Properly placed valves shall be installed to break down large systems in smaller manageable positive flow loops for flushing. Where this is not possible, venting must be provided.
- .4 Unions shall be installed on either side of small control valve assemblies on terminal units to allow removal for cleaning if flushing operation is not fully satisfactory.
- .5 Adequate air separators/bleed points required at the top of piping systems as well as at any vertical jog within the system. Locations of these points shall be indicated on the as-built drawings
- .6 Sequence of Cleaning:
 - a. Specifications shall state that the following sequence of flushing must be carried out by a fully qualified sub-contractor:
 - i. All systems shall be flushed with water at a flow rate not less than 1.25 times design flow for system utilizing exterior source pumps with tube bundles of exchangers removed and strainers installed and operational.
 - ii. Drain water and clean strainers, etc.
 - iii. Add chemical cleaning product to the system and circulate for 72 hours. Following the cleaning, ensure system is flushed with fresh make-up water while bleeding to remove all traces of the cleaner.
 - iv. Clean strainers, repeat water wash and clean and check strainers.
 - v. Install tube bundles and commission system.
- .5 Metal ducts:
 - .1 Use quality hardware for balancing dampers to facilitate the balancing operation and to ensure positive locking of the damper.
 - .2 Provide pitot tube openings, complete with spring-loaded caps, on all supply, return and exhaust systems around major equipment. Make adequate provision where insulation is encountered.
 - .3 Flexible duct connections need to be made of an anti-bacterial material.
- .6 Coils:
 - .1 Cooling coils shall be cleanable and drainable. The tubes should be readily accessible without having the need to disconnect piping.
 - .2 Cooling coils shall be counter flow type and installed according to manufacturer's specifications.
 - .3 Preheat coils shall make use of glycol for protection against freezing.
 - .4 Piping to the coils should be arranged so as not to interfere with the

cleaning operation.

- .5 Sufficient working room should be provided at both ends of the coils so as to enable the use of a probe the same length as that of a tube.
 - .6 Dry layup piping consisting of 1 ½ ABS connections from the coil piping to the AHU supply or return shall be included on all chilled water coils.
 - .7 Coils should have ½" connection at the top of the coils to allow for compressed air connection.
 - .8 ½" drain at bottom of coil
 - .9 1 1/2" XFR piping connection from supply air duct to chilled water return line (to allow constant air flow in coil)
- .7 Chillers:
- .1 Chill water coils shall be sized for a 9°C chill water delta-T on design day (6 C degree supply, 15 C return water temperatures).
 - .2 Pressure gages are required across all AHU coils and filter banks (filter and pre-filter combined).
 - .3 Air-cooled condensers shall be capable of operating at 95°F ambient temperature with 30°F temperature difference between air entering and leaving the condenser. Air-cooled condensers on roofs shall be capable of operating at 105°F ambient temperature.
 - .4 Pressure gages are required across all AHU coils and filter banks (filter and pre-filter combined).
- .8 Exhaust fan: Shall have speed control switch.

Products:

- .1 Filters: Shall be for two-stage air filtration at AHUs. Pre-Filter to be 2 inches pleated, High-Capacity, MERV 7, initial resistance 0.17" WC at 400 FPM. Final Filter shall be 12 inches pleated, V style, High Capacity MERV 14, initial resistance 0.275" wc at 400 fpm.
- .2 Intake and Exhaust Louvers: In prepainted or anodized Aluminum extrusions. To be equipped with bird screen and insect screen, easily removed from the interior of the duct shaft.
 - Suggested (or equivalent) Product: As manufactured by E.H.Price.

End of Section

23 01 05 Operation and Maintenance of HVAC Systems During Construction

- .1 Operation of existing systems during construction shall be limited based on the needs of occupants and protection of freeze-prone systems. Such operation required during construction must be approved by FMP.
- .2 Provisions/protections shall be utilized to minimize construction dust and debris from entering the system as well as being transferred to other occupied spaces.
- .3 Filters shall be replaced for all systems utilized during construction at the time of substantial completion at the cost of the contractor.
- .4 The Mechanical Consultant shall propose options for HVAC systems depending on the application, to be reviewed and approved by the FMP.

End of Section

23 01 31 Air Duct Cleaning for HVAC Systems

- New installations shall be inspected by HVAC consultant and if required shall be cleaned at the cost of the contractor.

End of Section

23 05 00 Common Work Results for HVAC

- .1 Design Consultants shall develop reliable and innovative solutions to facilitate design requirements.
- .2 Periodic design progress reviews and system evaluations and recommendations must be scheduled with Carleton University's Facilities Management and Planning (CUFMP) for acceptability. Consultants are required to submit a report identifying all building systems intended for inclusion within the facility design, their function and relationship to each other with regard to centralized control and monitoring, effective maintenance, and provisions for future expansion, and sustainable operations.

Design Brief:

As early as possible in the design stage, CUFMP shall be provided with a design brief for mechanical design regarding the proposed mechanical system including provisions for future expansion, sustainability criteria, and economic analysis of system selection, effective maintenance, and data that would be of value to operating personnel. The consultant must follow the Carleton University project procedure for TSSA for work on pressure vessels or piping that operates above 15 psig, and on air lines greater than ¾" that operate above 15 psig.

As-Built Drawings:

The Consultant is responsible for the quality of shop drawings, as-built drawings, and maintenance manuals (see General Conditions of Contract and Prime Consultant Agreement). This information is of great value to the University, and every effort shall be made to ensure that complete and accurate information is provided by the Contractor and equipment suppliers and is sufficiently detailed for the project to be effectively implemented and for ongoing maintenance and operation.

Mechanical Drawings:

Mechanical drawings shall be sufficiently detailed to ensure that the project can be effectively implemented, and incorporates schematics as follows.

Green Globe Certification:

Work with FMP through design evaluation workshops and review meetings to develop the sustainable design strategies for the project and complete the design level and construction level worksheets.

Complete piping showing:

- .1 all take-offs
- .2 all valves, gauges, pressure and temperature taps, flex connectors, air vents, balancing valves
- .3 direction of flow
- .4 temperature and pressure of medium (max. and min. where variable) and pipe sizes
- .5 pump characteristics:
 - head
 - flow in gallons

- .6 control valves characteristics:
 - type of control valve
 - flow in gallons
- .7 heat exchanger characteristics:
 - pressure loss (design)
 - capacity (GPM #/hr. steam high temp. and med. temp. water) differential temperature
- .8 steam trap characteristics:
 - capacity
 - type
- .9 coil characteristics:
 - quantity GPM
 - head loss water side

Complete air systems showing:

- .1 all take-offs labelled correct sequence and identified by area or areas
- .2 all system components
- .3 duct sizes and capacities (max. and min. where variable) component capacities
- .4 temperature (design) throughout system (max. and min. where variable)
- .5 stated amount of exfiltration, infiltration pressurization designed for by area
- .6 all return air systems and exhaust air systems should include:
 - capacity CFM
 - Identification of what constitutes duct, i.e. ceiling space, structural shaft, etc.

Fan characteristics:

- capacity (max. and min. where variable)
- Pressure design “WG”

Coil Characteristics:

- capacity CFM (max. and min. where variable)
- entering and leaving air temperatures (max. and min.)
- air pressure drop “WG”
- number of rows and type of flow, i.e. counter or parallel

Filters Characteristics:

- design flow rate FPM
- design static loss (max. allowed)

Damper Characteristics:

- balancing damper locations
- fire damper locations

Complete plumbing systems showing:

- .1 all take-offs labelled in correct sequence
- .2 complete venting system
- .3 pipe sizes and fixture units
- .4 isolation valves

Complete systems of all other miscellaneous and auxiliary systems showing:

- .1 take-offs labelled in correct sequence
- .2 all components and their characteristics
- .3 all line sizes and flow capacities
- .4 all systems drop or losses where such effects design or operation
- .5 complete list of flow quantities designed into systems for future expansion

HYDRONIC PIPING

1. Cleaning of Hydronic and Steam Systems:
 - a. Mechanical provisions to facilitate cleaning, and to ensure adequate flushing and cleaning of piping systems can be and does get carried out by the contractor and a cleaning, subcontractor, the following provisions shall be designed and installed:
 - i. Tube bundles of all heat exchanges must be removable to allow flushing of water and solvents through the exchanger shell with tube bundle removed (the flushing provision applies to both steam and water media).
 - ii. Contractor shall provide a fabricated cone strainer to be inserted across exit piping from the exchanger shell to trap solids in shell for easy removal.
 - iii. T-type strainers complete with pressure tappings on inlet and outlet shall be installed on the supply lines to systems where such systems leave equipment rooms (this requirement is in addition to strainers installed ahead for control valves to pumps).
 - b. 2" diameter or line size (whichever is larger) blind flanged stub shall be provided:
 - i. on suction and discharge side of all pumps on all heating and chilled water systems
 - ii. on all steam and condensate systems to allow injection, circulation and removal of flushing water and solvents from systems.
 - c. Properly placed valves shall be installed to break down large systems in smaller manageable positive flow loops for flushing. Where this is not possible, venting must be provided.
 - d. Unions shall be installed on either side of small control valve assemblies on terminal units to allow removal for cleaning if flushing operation is not fully satisfactory.
 - e. Adequate air separators/bleed points required at the top of piping systems as well as at any vertical jog within the system. Locations of these points shall be indicated on the as-built drawings.
2. Sequence of Cleaning:
 - a. Specifications shall state that the following sequence of flushing must be carried out by a fully qualified sub-contractor :
 - i. All systems shall be flushed with water at a flow rate not less than 1.25 times design flow for system utilizing exterior source pumps with tube bundles of exchangers removed and strainers installed and operational.
 - ii. Drain water and clean strainers, etc.
 - iii. Add chemical cleaning product to the system and circulate for 72 hours. Following the cleaning, ensure system is flushed with fresh make-up water while bleeding to remove all traces of the cleaner.
 - iv. Clean strainers, repeat water wash and clean and check strainers.
 - v. Install tube bundles and commission system.
 - b. The entire sequence of operations must be supervised by the Consultant, and the FMP

must be provided advance notice of the schedule. Final installation of tube bundles to be witnessed by Consultant and FMP.

3. Use Quatic, Drew, Nalco Betzdearborn systems and chemicals only.
4. Flexible connections to be by Flexonics or approved alternate.

COILS

1. Cooling coils shall be cleanable and drainable. The tubes should be readily accessible without having the need to disconnect piping.
2. Cooling coils shall be counter flow type and installed according to manufacturer's specifications.
3. Preheat coils shall make use of glycol for protection against freezing.
4. Piping to the coils should be arranged so as not to interfere with the cleaning operation.
5. Sufficient working room should be provided at both ends of the coils so as to enable the use of a probe the same length as that of a tube.
6. Dry layup piping consisting of 1 ½ ABS connections from the coil piping to the AHU supply or return shall be included on all chilled water coils.
 1. Coils should have ½" connection at the top of the coils to allow for compressed air connection.
 2. ½" drain at bottom of coil
 3. 1 1/2" XFR piping connection from supply air duct to chilled water return line (to allow constant air flow in coil)
 4. Pictures are attached below:



AIR HANDLING

1. General:

1. The Mechanical Consultant shall propose options for HVAC systems depending on the application, to be reviewed and approved by the FMP.

2. Intake and Exhaust Louvres:

1. Louvres shall be equipped with bird screen, easily removed from the interior of the duct shaft. Consideration must be given to locate in area away from vehicle fumes and building exhausts (loading docks).
2. Dampers shall be Tamco or Rusco.

3. Mixed Air Plenums:

1. Mixed air plenums shall be designed to ensure complete mixing of fresh and return air to eliminate stratification.
2. Blenders shall be used to ensure that proper mixing occurs, or provide information on design alternatives

4. Air Handling Equipment:

1. Air handling equipment shall be located in areas which will permit ready access for servicing and removal of components for repairs.
2. Centrifugal fans shall be statically and dynamically balanced. Provision for on-site balancing shall be made by having an access door installed in the fan housing.
3. Inlet volume control dampers shall not be used for balancing purposes.
4. Axial flow fans are not to be used.
5. Motors shall be designed to accommodate the acceleration rate of the load without reducing motor life and shall be designed to operate on VFD.
6. A heat recovery system shall be incorporated into the design of the air handler. Acceptable types of heat recovery systems are thermal wheel, plate heat exchanger and other viable heat recovery techniques that have the approval of FMP.
7. Economizer high limit controls shall also be incorporated into the design if technically feasible.
8. Accepted Air Handling Equipment Manufacturers.
 1. Haakon Industries
 2. Ingenia Technologies Inc.
 3. MAFNA Air Technologies Inc.
 4. Racan Carrier
 5. Ventrol
9. Vibration isolation required.

5. Filtration upstream of AHU Coils:

1. Provide air filters of appropriate type for the application. Filters shall comply with the following:
 - i. Pre-filters: material shall be polyester media pad and have Class II rating by Underwriters Laboratories of Canada (UL). MERV 6 minimum. Filter requirements shall conform to ASHRAE Test Standard No. 52-76 and independent test results shall be provided with shop drawings.

- ii. 1" thickness – single-ply dry (based on 24"x24" pad): filters shall have an average synthetic dust weight filtration of not less than 75% and a dust holding capacity of not less than 125 grams, both at a final pressure drop of 1.0 in. W.G. and a face velocity of 500 F.P.M.
- iii. 2" thickness – double-ply combination 1-ply dry: 1-ply tackified (based on 24"x24" pad): filters shall have an average synthetic dust weight filtration of not less than 80% and a dust holding capacity of not less than 140 grams both at a final pressure drop of 1.0 in. W.G. and a face velocity of 500 F.P.M.
- iv. After filters: filters shall be self-supporting cartridge type, filter media shall have Class II rating by Underwriters Laboratories of Canada (UCL) and be labeled as such. Average atmospheric dust spot efficiency shall not be less than 80% as determined by ASHRAE Standard 52-76 test method. Do not use roll-type air filters, permanent washable filters or electrostatic filters. MERV 13 minimum.
- v. Filter frames shall not be cardboard.
- vi. Magnehelic type differential pressure gauge shall be provided across each air filter bank.
- vii. Filter specification to be approved by FMP.

6. Roof Top Unit Air Handlers

- 1. For applications where an independent Roof Top Unit (RTU) will be installed, the preferred method is that the unit comes with a terminal strip that allows Carleton to operate the unit directly as opposed to an integrated controls package shipped with the unit.

Points that Carleton would control would include:

- 1. Fan (s) Start/Stop
- 2. Cooling Stages (Binary Outputs from BAS)
- 3. Heating Stages (Binary Outputs from BAS) or heating re-set signal (0-10 volts) if modulating
- 4. Economizer Control (Analog output from BAS)
- 5. Heat Wheel enable (if applicable)

- 2. The unit should have an 'economizer' option so 'free cooling' can be utilized.

- 3. Acceptable Manufacturers are as follows:

- 1.) AAON
- 2.) Engineered Air
- 3.) Carrier
- 4.) Other manufacturers will be acceptable if they can meet the above requirements and must be first approved by FMP.

- 4. Vibration isolation required.

DUCTWORK ACCESSORIES

1. Dampers:
 1. Use quality hardware for balancing dampers to facilitate the balancing operation and to ensure positive locking of the damper.
 2. Tamco Series 1000 shall be used for return air dampers. Tamco Series 9000 shall be used for outside air and exhaust air dampers. Opposed blade dampers shall be used for modulating service and parallel blade dampers for two-position service.
 3. Blades on multi blade dampers not to exceed 200mm (8") in width and 1220 mm (48") in length.
2. Pitot Tube Penetration:
 1. Provide Pitot tube openings, complete with spring-loaded caps, on all supply, return and exhaust systems around major equipment. Make adequate provision where insulation is encountered.
 2. This should be supplied and installed by the balancing contractor.
1. Access Panels:
 1. Provide access panels on walls, ceilings and ductwork to ensure that major mechanical equipment is readily accessible for servicing.
2. Fire Dampers:
 2. All fire dampers shall be of a type and design to allow visual inspection.
 3. Area in front of fire dampers must remain free of piping, ducting, etc. to allow access for maintenance.
 4. Access doors must allow full servicing access to all fire dampers. Fire damper installation shall comply with ULC standards.
 5. Spare fusible links to be provided.
6. Ceiling Air Outlets:
 1. Install ceiling air diffusers consistent with ceiling grids and are located in the centre of ceiling tiles where applicable. Exact location of any ceiling diffuser is to be as shown on architectural reflected ceiling plans.
 2. Return air inlets shall be placed to prevent short-circuiting.
 3. Round diffusers are preferred.
 4. Do not use linear diffuser unless specifically approved by FMP.

End of Section

23 05 13 Common Motor Requirements for HVAC Equipment

- Motors shall be of high efficiency type and be equipped with grounding rings for VFD applications

End of Section

23 05 15 Common Installation Requirements for HVAC Pipework

- .1 Provisions shall be made to drain the system in its entirety, this may result in several drain locations and shall be clearly marked on as built drawings
- .2 High points and any vertical jog in piping system shall be equipped with a means of air release c/w isolation valve for future maintenance

End of Section

23 05 16 Expansion Fittings and Loops for HVAC Piping

- Shall be determined by the design team as required

End of Section

23 05 19 Meters and Gauges for HVAC Piping

- Shall be equipped with isolation valve(s) and unions or flanges for maintenance and replacement

End of Section

23 05 19.13 Thermometers and Pressure Gauges – Piping Systems

- .1 Gauges are to be used across pumps. All gauges are to be provided with shut-off valves. Refer to Figure 1.
- .2 Thermometers are to be installed in wells. Bottom of well is to be 1/3 inside the pipe and is to be stainless steel. All gauges and thermometers must be easily removable and readable. Standard ranges for thermometers to be: chilled water 0 – 30°C, condenser water 0 – 50°C, all other services 0 – 110°C
- .3 Domestic water pressure gauge is to be located at the entry to the building main mechanical room or after the building isolation valve.

End of Section

23 05 29 Hangers and Supports for HVAC Piping and Equipment

- .1 All piping hangers will be clevis type, when expansion is an issue, then roller hangers are to be installed. Refer to Figure 2.
- .2 There is to be 1/8" thick by 4" wide rubber pad between hanger and piping.
- .3 Pipe hangers shall not be suspended buy insulation.
- .4 All piping hangers will be clevis type, when expansion is an issue, then roller hangers are to be installed. Refer to Figure 2.
- .5 There is to be 1/8" thick by 4" wide rubber pad between hanger and piping.
- .6 Pipe hangers shall not be suspended buy insulation.

End of Section

23 05 33 Heat Tracing for HVAC Piping

- The design of piping systems shall be in such a manner to avoid the need or use of heat tracing.

End of Section

23 05 48 Vibration and Seismic Controls for HVAC

- .1 Use ASHRAE guide for determining the recommended noise level limits and NC curves. Select mechanical equipment that will not produce noise and vibration beyond the recommended noise criteria for the space under consideration.
- .2 All equipment subject to vibration shall be adequately supported on isolation devices to limit transmission of vibration to an acceptable level. The following charts can be used as a general guide to transmission efficiencies, in permanent transmission.

Centrifugal Fans

RPM	400	600	800	1000	1200	1500	2000
Basement	10	6	5	4	4	4	3
Penthouse	4	3	2	2	2	2	2

Air Compressors, Vacuum Pumps

RPM	400	600	800	1000	1200	1500	2000
Basement	10	6	5	4	4	3	3
Penthouse	4	3	2	2	2	2	1

Axial Fans

RPM	400	600	800	1000	1200	1500	2000
Basement (ceiling-mounted)	10	6	5	4	4	3	2
Penthouse	4	2.5	2	2	1.5	1.5	1.5

End of Section

23 05 48.16 Seismic Restraint Systems (SRS) – Type P2 Buildings

- Shall be engineered.

End of Section

23 05 53 Identification for HVAC Piping and Equipment

- .1 All piping and equipment in exposed locations such as equipment rooms, pipe service chases, ceiling spaces, etc., shall be clearly labelled and identified to reflect ANSI/ASME colour coded installation guide and sizing. Refer to Figure 3.
- .2 For pipes over 3" in diameter and all ducts, the lettering shall be 2" high.
- .3 Each label and arrow shall be further held in place by a banding tape at each end, of the same colour as the label background, and of width equal to the lettering height.
- .4 Markers to be Brady All-Temperature B-350 Perma-Code, or B-500 vinyl cloth or approved alternate.
- .5 Identification shall be applied where view is not obstructed. Apply at each valve and where pipes leave or enter a room. Also apply no more than 25 feet apart on long runs. Where label will not stick to a surface, wrap with PVC pipe wrap and apply label to it.
- .6 Conform to colours coding schedule CGCB 1-GP-12c. Classifying colours and markers to be easily seen from floor. Identify both sides when piping passes through walls or floors. Identify piping at start and end points and at major manual and automatic valves. See Figure 3.
- .7 For identification of ductwork use 2" high black stenciled letters easily seen from floor. Provide markers on underside of suspended ceiling to locate boxes.
- .8 For identification of valves and controllers use laminated plastic tags with $\frac{3}{4}$ " engraved lettering.
- .9 Provide flow diagrams and mount in mechanical room and place copy in maintenance manual.

For piping identification, conform to the following:

Pipe Marker Legend	Valve Tag Legend	Primary Colour	Secondary
Cold Water	CW	green (light)	none
Chilled Water Supply	CHWS	green (dark)	none
Chilled Water Return	CHWR	green (dark)	none
Dom. Hot Water Supply	DHWS	green (light)	none
Dom. Hot Water Recirc	DHWR	green (light)	none
Hot Water Heating			
Supply up to 120°C	HWS	yellow	black
Glycol	GL		
Hot Water Heating			
Return up to 120°C	HWR	yellow	black
Steam Condenser	Steam, kpa	yellow	black
Return	CR	yellow	black
Adm. Sewer	SANS	green (dark)	none
Engine Exhaust	EE	yellow	black
Compressed Air			
Gauge Pressure			
120 psi and lower	CA, kpa	green (dark)	none
Fire Protection Water	ZPW	red	white
Sprinkler Water	SW	red	white
Vent (plumbing)	VP	green (dark)	none
Liquid Nitrogen	LN		
Distilled Water	DW		
Natural Gas	NG	yellow	

End of Section

23 05 92 Integrated Systems Testing

Fire Alarm and Systems Equipment Testing:

Testing shall be in accordance with applicable ULC standards. The following format is to be followed when a new fire protection system is installed into a new building or an existing building. All items that do not meet the standards set by Facilities Management and Planning and/or the Consultant are to be noted in the appropriate section.

.1 Emergency Generator:

- a. Run generator to ensure it is operational
- b. Ensure all gauges are functioning properly and are registering the specified level
- c. Cut main power switch to see if generator cuts in automatically
- d. Ensure all dampers open and stay open until generator has stopped
- e. Perform load test
- f. Ensure TSSA compliance requirement are fully adhered to.

.2 Fire Pump:

- a. With emergency generator off, test fire pump to ensure it is functioning properly, checking rotation and pressure gauges
- b. Ensure all pressure relief valves are as specified
- c. With emergency generator on and water pressure reduced, test to see if pump automatically starts
- d. Perform flow test

.3 Elevators:

- a. Where applicable, ensure elevators function properly with the emergency generator running. There are some buildings on campus that require this. Consult with FMP representative.
- b. Perform functions test
- c. Emergency phone system is unique to Carleton University and needs to be coordinated and tested with Carleton Computing Services (CCS).

.4 Sprinkler System:

- a. Check for proper water flow at each inspector's station on each level of the building
- b. Check to ensure that all flow indicating valves are hooked up properly back to the CACF, main fire alarm panel
- c. Check fire alarm panel to ensure proper signal is being sent from all flow indicating valves

.5 Fire Alarm Equipment Test:

- a. Test all smoke detectors
- b. Test all heat sensors
- c. Test all pull boxes
- d. Test all horns
- e. Ensure fire alarm panel functions properly
- f. Ensure door switch alarm (if specified) is hooked up properly
- g. With alarm on, ensure elevators operate properly
- h. Test fan shut down interlocks

.6 Hook-up to Central Reporting Station:

- a. Once entire system has been verified, connect line from Central Reporting Station to CACF

End of Section

23 05 93 Equipment Testing, Adjusting and Balancing

General

.1 Description - Testing, Adjusting, and Balancing (TAB) of Heating, Ventilation and Air-conditioning (HVAC) Systems.

TAB includes the following:

- a. Planning systematic TAB procedures
- b. Design review report
- c. Systems inspection report
- d. Duct air leakage test report
- e. Systems readiness report
- f. Balancing air and water distribution systems; adjustment of total system to provide design performance; and testing performance of equipment and automatic controls
- g. Vibration and sound measurements
- h. Recording and reporting results

.2 Definitions:

- a. Basic TAB used in this Section: Chapter 36, "Testing, Adjusting and Balancing" of ASHRAE Handbook, "HVAC Applications"
- b. TAB: Testing, Adjusting and Balancing; the process of checking and adjusting HVAC systems to meet design objectives
- c. AABC: Associated Air Balance Council
- d. NEBB: National Environmental Balancing Bureau
- e. Air Systems: includes all outside air, supply air, return air, exhaust air and relief air systems
- f. Hydronic Systems: includes chilled water, condenser water, heating hot water and glycol-water systems
- g. Flow rate tolerance: the allowable percentage variation, minus to plus, of actual flow rate from design values in the contract documents

.3 Related Sections:

- a. Section 01400, General Requirements – Quality Control

- b. Section 15010, Basic Mechanical Requirements
- c. Section 15240, Mechanical - Sound, Vibration and Controls
- d. Section 15260, Mechanical – Piping Insulation
- e. Section 15850, Air Handling
- f. Section 15910, Ductwork
- g. Section 15950, Controls for HVAC
- h. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this Section

.4 Quality Assurance:

- a. Refer to Section 01300 Submittals and Section 01400 Quality Control
- b. Qualifications:
 - i. TAB Agency: the TAB Agency shall be a subcontractor through cash allowance of the General Contractor and shall be paid by the General Contractor. The TAB agency shall report to Carleton FMP. The work will be paid for by the General Contractor from a cash allowance carried by the General Contractor.
 - ii. The TAB Agency shall be either a certified member of AABC or certified by the NEBB to perform TAB service for HVAC, water balancing and vibrations and sound testing of equipment. Any agency that has been the subject of disciplinary action by either AABC or the NEBB within the five years preceding Contract Award shall not be eligible to perform any work related to the TAB.
 - iii. TAB Specialist: the TAB Specialist shall be either a member of AABC or an experienced technician of the Agency certified by NEBB. If, for any reason, the Specialist loses subject certification during this period of work, the General Contractor shall immediately notify the consulting engineer and submit another TAB Specialist for approval.
 - iv. TAB Specialist shall be identified by the General Contractor within 30 days after the notice to proceed. The TAB Specialist will be coordinating, scheduling and reporting all TAB work and related activities and will provide necessary information as required by the Consulting Engineer. The responsibilities specifically include:
 - Directly supervising all TAB work.
 - Signing the TAB reports that bear the seal of the TAB standard. The reports shall be accompanied by report forms and schematic drawings required by the TAB Standard, AABC or NEBB.
 - Following all TAB work through its satisfactory completion.
 - Providing final markings of settings of all HVAC adjustment devices.
 - Permanently marking location of duct test ports.

- c. All TAB technicians performing actual TAB work shall be experienced and must have done satisfactory work on a minimum of three (3) projects comparable in size and complexity to this project. Qualifications must be certified by the TAB agency in writing.
- d. Test Equipment Criteria: the instrumentation shall meet the accuracy/calibration requirements established by AABC National Standards or by NEBB Procedural Standards for Testing, Adjusting and Balancing of Environmental Systems and instrument manufacturer. Provide calibration history of the instruments to be used for test and balance purpose.
- e. TAB Criteria:
 - i. One or more of the applicable AABC, NEBB or SMACNA publications, supplemented by ASHRAE Handbook “HVAC Applications” Chapter 36, and requirements stated herein shall be the basis for planning, procedures and reports.
 - ii. Flow rate tolerances: the following tolerances are allowed. For tolerances not mentioned herein follow ASHRAE Handbook “HVAC Applications”, Chapter 36, as a guideline. Air Filter resistance during tests, artificially imposed if necessary, shall be at least 90% of final values for pre-filters and after-filters.
 - Air handling unit and all other fans, cubic meters/min (cubic feet per minute): minus 0% to plus 10%.
 - Air terminal units (maximum values): minus 2% to plus 10%.
 - Exhaust hoods/cabinets: 0% to plus 10%.
 - Minimum outdoor air: 0% to plus 10%.
 - Individual room air outlets and inlets, and air flow rates not mentioned above: minus 2% to plus 10% except if the air to space is 100cfm or less the tolerance would be 0% to plus 5%.
 - Heating hot water pumps and hot water coils: minus 5% to plus 5%.
 - Chilled water and condenser water pumps: 0% to plus 5%.
 - Chilled water coils: 0% to plus 5%.
- f. Systems shall be adjusted for energy efficient operation as described in Part 3 - Execution
- g. Typical TAB procedures and results shall be demonstrated to the Consulting Engineer and FMP Representative for one air distribution system (including all fans, three terminal units, three rooms) and one hydronic system (pumps and three coils) as follows:

- i. When field TAB work begins.
- ii. During each partial final inspection and the final inspection for the project.

.5 Submittals:

- a. Submit in accordance with Section 01300, General Requirements – Submittals
- b. Submit names and qualifications of TAB agency and TAB specialists within 30 days after notice to proceed. Submit information on three recently completed projects and a list of proposed test equipment.
- c. For use by the Consulting Engineer and FMP representative, submit two complete set of applicable AABC or NEBB publications that will be the basis of TAB work.
- d. Submit following for review and approval:
 - i. Design Review Report, within 30 days, after the system layout on air and water side is completed by the Contractor.
 - ii. Systems inspection report on equipment and installation for conformance with design.
 - iii. Duct Air Leakage Test report.
 - iv. Systems Readiness report.
 - v. Intermediate and Final TAB reports covering flow balances and adjustments, performance tests, vibration tests and sound tests.
 - vi. Include in final reports uncorrected installation deficiencies noted during TAB and applicable explanatory comments on test results that differ from design requirements.
- e. Prior to request for final or partial final inspection, submit completed Test and Balance report for the area.

.6 Applicable Publications:

the following publications form a part of this specification to the extent indicated by the reference thereto. In text the publications are referenced to by the acronym of the organization.

- a. American Society of Heating, Refrigeration and Air Conditioning Engineers, Inc. (ASHRAE):
 - i. 2003 HVAC Applications ASHRAE Handbook, Chapter 37, Testing, Adjusting, and Balancing and Chapter 47, Sound and Vibration Control and Guideline Zero.
- b. Associated Air Balance Council (AABC):
 - i. 2002 AABC National Standards for Total System Balance.
- c. National Environmental Balancing Bureau (NEBB):
 - i. 7th Edition 2005 Procedural Standards for Testing, Adjusting, balancing of Environmental Systems.
 - ii. 1st Edition 1994 Procedural Standards for the Measurement and Assessment of Sound and Vibration.
 - iii. 2nd Edition 1999 Procedural Standards for Building Systems Commissioning.
- d. Sheet Metal and Air Conditioning Contractors National Association (SMACNA):
 - i. 3rd Edition 2002 HVAC SYSTEMS – Testing, Adjusting and Balancing.

Products

1. Plugs:
 - a. Provide proper Pitot tube opening (Duro-Dyne Type IP-4) to seal holes drilled in ductwork for test purpose.
2. Insulation Repair Material:
 - a. Provide for repair of insulation removed or damaged during TAB work.

Execution

1. General:
 - a. Refer to TAB Criteria in Article, Quality Assurance.
 - b. Obtain applicable contract documents and copies of approved submittals for HVAC equipment and automatic control systems.
2. Design Review Report:
 - a. The TAB Specialist shall review the Contract Plans and specifications and advise the Consulting Engineer of any design issues that would prevent the HVAC systems from effectively operating in accordance with the sequence of operation specified or prevent the effective and accurate TAB of the system. The TAB Specialist shall provide a report individually listing each issue and the corresponding proposed corrective action necessary for proper system operation.
3. System Inspection Report:
 - a. Inspect equipment and installation for conformance with design.
 - b. The inspection and report is to be done after air distribution equipment is on site and duct installation has begun, but well in advance of performance testing and balancing work. The purpose of the inspection is to identify and report deviations from design and ensure that systems will be ready for TAB at the appropriate time.
 - c. Reports: Follow check list format developed by AABC, NEBB or SMACNA, supplemented by narrative comments, with emphasis on air handling units and fans. Check for conformance with submittals. Verify that diffuser and register sizes are correct. Check air terminal unit installation including their duct sizes and routing.
4. Duct Air Leakage Test Report:
 - a. All tests shall be performed in the presence of the Consulting Engineer and the TAB agency. The Test and Balance agency shall measure and record duct leakage and report to the Consulting Engineer and identify leakage source with excessive leakage.
5. System Readiness Report:
 - a. Inspect each system to ensure that it is complete including installation and operation of controls.
 - b. Verify that all items such as ductwork piping, ports, terminals, connectors, etc., required for TAB work are installed. Provide a report to the Consulting Engineer.
6. TAB Reports:
 - a. Submit an intermediate report for 25% of systems and equipment tested and balanced to establish satisfactory test results.

- b. The TAB agency shall provide raw data immediately in writing to the Consulting Engineer if there is a problem in achieving intended results before submitting a final report.
- c. If over 20% of readings in the intermediate report fall outside the acceptable range, the TAB report shall be considered invalid and all contract TAB work shall be repeated and re-submitted for approval.
- d. Do not proceed with the remaining systems until intermediate report is approved by the Consulting Engineer.

7. Tab Procedures:

- a. TAB shall be performed in accordance with the requirement of the Standard under which TAB agency is certified by either AABC or NEBB.
- b. General: during TAB all related system components shall be in full operation. Fan and pump rotation, motor loads and equipment vibration shall be checked and corrected as necessary before proceeding with TAB. Set controls and / or block off parts of distribution system to simulate design operation of variable volume air or water systems for test and balance work.
- c. Coordinate TAB procedures with any phased construction completion requirements for the project. Provide TAB reports for each phase of the project prior to partial final inspection of each phase of the project.
- d. Allow sufficient time in construction schedule for TAB and submission of all reports for an organized and timely correction of deficiencies.
- e. Air Balance and Equipment Test (edit the following list to include all air devices on project which require balancing): Include air handling units, fans, terminal units, fan coil units, room diffusers/outlets/inlets, computer room A/C units, student dorms A/C units, and laboratory fume hoods and cabinets.
 - i. Artificially load air filters by partial blanking to produce air pressure drop of at least 90% of the design final pressure drop.
 - ii. Adjust fan speed to provide design air flow.
 - iii. Test and balance systems in all specified modes of operation, including variable volume, economizer, and fire emergency modes. Verify that dampers and other controls function properly.
 - iv. Variable air volume (VAV) systems:
 - Coordinate TAB, including system volumetric controls, with Delta control system.
 - Check and readjust air terminal unit rates if necessary (to factory specified min and max flow rates). Balance air distribution from ATU on full cooling maximum scheduled cubic meters per minute (cu ft. per minute). Reset room thermostats and check ATU operation from maximum to minimum cooling, to the heating mode, and back to cooling. Record and report the heating coil leaving air temperature when the ATU is in the maximum heating mode.

- i. Record final measurements for air handling equipment performance data sheets.
 - f. Air Balance and Equipment Test (edit the following list to include all air devices on project which require balancing): Include circulating pumps, convertors, coils, coolers and condensers:
 - i. Coordinate water chiller flow balancing with the Chiller spec.
 - ii. Adjust flow rates for equipment. Set coils and evaporator to values on equipment submittals, if different from values on contract drawings.
 - iii. Primary – secondary (variable volume) systems: Coordinate with Controls Specification for HVAC. Balance systems at design water flow and then verify that variable flow controls function properly.
 - iv. Record final measurements for hydronic equipment on performance data sheets. Include entering and leaving water temperatures for heating and cooling coils, and for convertors. Include entering and leaving air temperatures (DB/WB for cooling coils) for air handling units and reheat coils. Make air and water temperature measurements at the same time.
- 8. Vibration Testing:
 - a. Furnish instruments and perform vibration measurements for all rotating HVAC equipment of 5HP and larger, including centrifugal/screw compressors, cooling towers, pumps, fans and motors.
 - b. Record vibration readings on air handling units, all fans, pumps, and end suction pumps per test data found in AABC National Standard 2002 appendices.
 - c. Submit a report to the Engineer. Where vibration readings exceed the allowable tolerances Contractor shall be directed to correct the problem. The TAB agency shall verify that the corrections are done and submit a final report to the Engineer.
- 9. Sound Testing:
 - a. Read and record sound levels at up to 15 locations in the building designated by the Engineer. All tests shall be conducted when the building is quiet, and in the presence of the Engineer, if desired.
 - b. The required sound levels shall be measured at any point within a room not less than six (6) feet from the air terminal or room unit, and not closer than three (3) feet from any floor, wall, or ceiling surface.
 - c. Sound levels shall be measured with the Octave Band Analyzer. The “A” scale shall be used to measure overall sound levels. The specified octave band levels shall be determined with the above sound meter set on “A”.
 - d. Sound reference levels, formulas and coefficients shall be according to ASHRAE Handbook, “HVAC Applications”, Chapter 46, Sound and Vibration Control.
 - e. Where measured sound levels exceed specified level, the installing contractor or equipment manufacturer shall take remedial action approved by the Engineer and necessary sound tests shall be repeated.

10. Marking of Settings:

- a. Following approval of TAB final Report, the setting of all HVAC adjustment devices including valves, splitters and dampers shall be permanently marked by the TAB Specialist so that adjustment can be restored if disturbed at any time. Style and colours used for markings shall be coordinated with the Engineer.

11. Identification of Test Ports:

- a. The TAB Specialist shall permanently and legibly identify the location points of duct test ports. If the ductwork has exterior insulation, the identification shall be made on the exterior side of the insulation. All penetrations through ductwork and ductwork insulation shall be sealed to prevent air leaks and maintain integrity of vapour barrier.

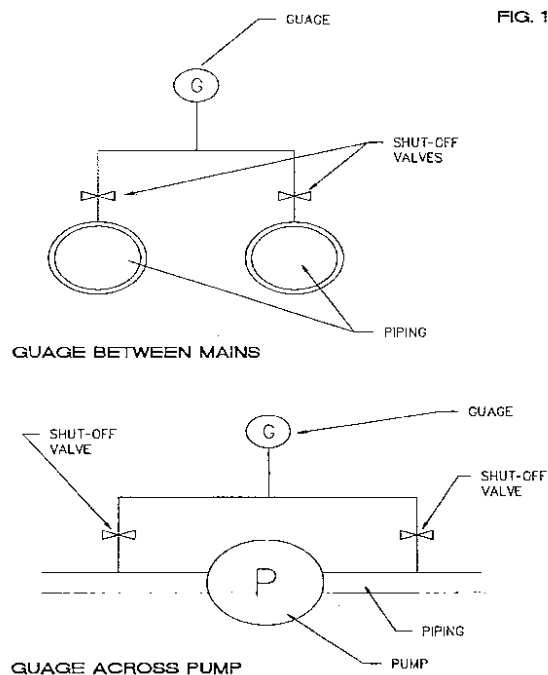
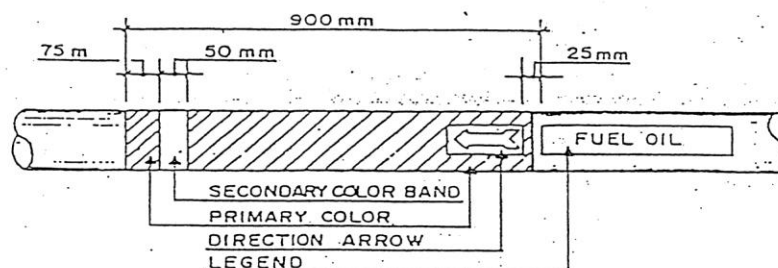
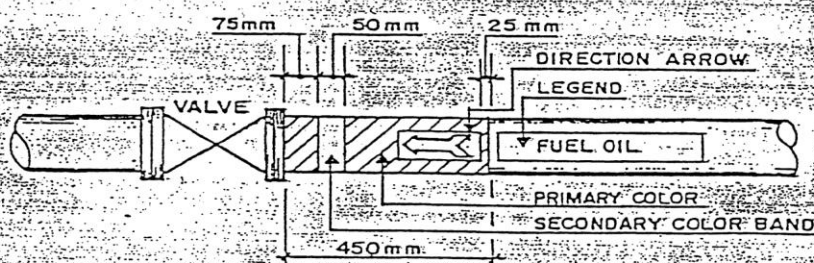


FIG. 3



ARRANGEMENT STRAIGHT PIPE RUNS



ARRANGEMENT AT VALVES & FITTINGS

All piping identifications shall be stencilled. Use of pre-pasted tape markers shall not be accepted.

End of Section

23 05 93.13 Testing, Adjusting and Balancing of Fume Hoods

Shall be performed per manufacturer's instructions in consultation with Carleton U EHS Team

End of Section

23 05 94 Pressure Testing of Ducted Air Systems

.1 Minimum testing per ASHRAE and SMACNA.

End of Section

23 07 13 Duct Insulation

- .1 All air intake and exhaust ducts shall be insulated to protect building interiors from frost and moisture damage
- .2 Materials on the ducts should be safely secured to ductwork
- .3 Welded pined Roxul board with corner beads is to be installed on all ductwork

End of Section

23 07 19 HVAC Piping Insulation

- .1 Insulate the following:
 - a. heating water and glycol supply and return piping and fittings
 - b. refrigerant suction gas pipes
 - c. steam and condensate piping and fittings
 - d. chilled water
 - e. domestic hot water
 - f. domestic cold water
 - g. plate exchangers
 - h. rain leader/roof hoppers
 - i. heating oil piping (CHP)
- .2 Insulate control valves with properly designed removable insulation.
- .3 Provide PVC surface finish, suitable for painting, to all exposed surfaces.
- .4 Piping insulation thickness should comply with current ASHRAE Standard 90.
- .5 Provide removable insulation on fittings, valves and end caps. Removable aluminum cans (Pittsburgh) fastened with screws on all fittings, valves and end caps. On oversized piping gored elbows shall be used.
- .6 Steam equipment and piping:
 - a. 4" Roxul mineral fiber
 - b. equipment inside building – aluminium embossed 16 ga. (removable)
 - c. exterior equipment – aluminium embossed 16 ga.
 - d. tank ends – segmented and profiled for personnel protection (Pittsburgh fittings – rounded edges)
 - e. mitered joint on 3" + piping system
 - f. all fittings are removable for service (valves, mitres, etc.)
 - g. all equipment and piping in Central Heating Plant and campus to be covered with embossed aluminium 16 ga
- .7 Steam condensate piping:
 - a. 2" Roxul mineral fiber
 - b. equipment inside building – aluminium embossed 16 ga. (removable)
 - c. exterior equipment – aluminium embossed 16 ga.
 - d. tank ends – segmented and profiled for personnel protection (Pittsburgh fittings–rounded edges)
 - e. mitered joint on 3" + piping system
 - f. all fittings are removable for service
- .8 Steam condensate piping:
 - a. 2" Roxul mineral fiber
 - b. equipment inside building
 - c. exterior equipment – aluminium embossed 16 ga.

- d. tank ends – segmented and profiled for personnel protection (Pittsburgh fittings – rounded edges)
- e. mitered joint on 3" + piping system
- f. all fittings are removable for service

.9 Chilled water system:

- a. 2" Roxul mineral fiber
- b. equipment inside building – PVC wrap (removable)
- c. exterior equipment – aluminium embossed 16 ga.
- d. tank ends – segmented and profiled for personnel protection (Pittsburgh fittings–rounded edges)
- e. mitered joint on 3" + piping system
- f. all fittings are removable for service

.10 Oil line:

- armor glass insulation and embossed aluminium cover 16 ga.

End of Section

23 08 16 Cleaning and Start-Up of HVAC Piping Systems

1. Cleaning of Hydronic and Steam Systems:
 - a. Mechanical provisions to facilitate cleaning, and to ensure adequate flushing and cleaning of piping systems can be and does get carried out by the contractor and a cleaning, subcontractor, the following provisions shall be designed and installed:
 - i. Tube bundles of all heat exchanges must be removable to allow flushing of water and solvents through the exchanger shell with tube bundle removed (the flushing provision applies to both steam and water media).
 - ii. Contractor shall provide a fabricated cone strainer to be inserted across exit piping from the exchanger shell to trap solids in shell for easy removal.
 - iii. T-type strainers complete with pressure tappings on inlet and outlet shall be installed on the supply lines to systems where such systems leave equipment rooms (this requirement is in addition to strainers installed ahead for control valves to pumps).
 - b. 2" diameter or line size (whichever is larger) blind flanged stub shall be provided:
 - i. on suction and discharge side of all pumps on all heating and chilled water systems
 - ii. on all steam and condensate systems to allow injection, circulation and removal of flushing water and solvents from systems.
 - c. Properly placed valves shall be installed to break down large systems in smaller manageable positive flow loops for flushing. Where this is not possible, venting must be provided.
 - d. Unions shall be installed on either side of small control valve assemblies on terminal units to allow removal for cleaning if flushing operation is not fully satisfactory.
 - e. Adequate air separators/bleed points required at the top of piping systems as well as at any vertical jog within the system. Locations of these points shall be indicated on the as-built drawings.
2. Sequence of Cleaning:
 - a. Specifications shall state that the following sequence of flushing must be carried out by a fully qualified sub-contractor :
 - i. All systems shall be flushed with water at a flow rate not less than 1.25 times design flow for system utilizing exterior source pumps with tube bundles of exchangers removed and strainers installed and operational.
 - ii. Drain water and clean strainers, etc.
 - iii. Add chemical cleaning product to the system and circulate for 72 hours. Following the cleaning, ensure system is flushed with fresh make-up water while bleeding to remove all traces of the cleaner.
 - iv. Clean strainers, repeat water wash and clean and check strainers.
 - v. Install tube bundles and commission system.
 - b. The entire sequence of operations must be supervised by the Consultant, and the FMP must be provided advance notice of the schedule. Final installation of tube bundles to be witnessed by Consultant and FMP.
3. Use Quatic, Drew, Nalco Betzdearborn systems and chemicals only.
4. Flexible connections to be by Flexonics or approved alternate.

End of Section

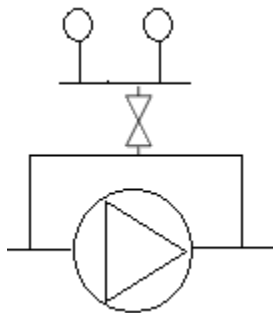
23 21 13.03 Pressure Joint Piping Systems Hydronic Systems

Use of such systems shall be limited to accessible locations, i.e. mechanical rooms. All other locations will require FMP acceptance

End of Section

23 21 23 Hydronic Pumps

1. Pumps in closed systems should be equipped with mechanical seals to minimize leakage.
2. Provide gland cooling for water systems over 180°F (82°C).
3. Use braded stainless steel flexible pump connectors where needed.
4. Piping to the pumps shall be adequately supported from the structure to eliminate stresses on the pump.
5. Provide 100% backup for systems circulation pumps of heating
6. Pumps should be direct drive where possible.
7. Provide gauges/gauge ports across pumps. All monitoring points must have a gauge. To allow for additional port (s) for pressure transducers, etc. there should be a tee-line installed with a valve on the line to allow for multiple connections if desired. See drawing below.



8. Provide a duplex system of fine mesh filters/strainers upstream of the pumps, complete with isolating valves.
9. Pumps used for continuous operation that have motors greater than 5Hp to be considered for Variable Speed Drives.
10. Pumps to be Armstrong, Grundfoss, or Myers.

End of Section

23 22 16 Steam Specialties

Mechanical Materials and Selection

The consultant must follow the Carleton University project procedure for TSSA, as well as follow all ASME B31 piping code requirements and CSA piping standards for all repairs/modification/additions to piping systems that operate above 15 psig, with air lines below $\frac{3}{4}$ " ID being the exception. Best industry practices should be implemented at all times.

Please provide a valve and equipment schedule that provides the following information:

- Valves: valve body style, pressure rating, flanged or welded, valve size, capacity
- Pumps: pump type, ft of head, inlet and outlet size, pump capacity, rpm, available discharge pressure, HP, performance characteristics (pump curve)
- Control Valves: valve body style, size, pipe schedule, turn down capacity, delta P across valve, valve characteristic (linear, equal %, quick opening), min/max flow, min/max inlet and outlet pressure, % flashing across valve
- Heat Exchangers and Coils: heat exchanger type (shell and tube, flooded, etc), pressure loss across, sq ft of heating surface, delta T based on heating fluid parameters, clean and dirty capacity
- Steam Trap: delta P characteristics, size, capacity, type, inlet and outlet dimensions

Equipment Selection

- Piping: Piping shall be selected based on fluid and application. Materials used in any pressure piping (over 15 psig) must be traceable to a material data report, and must meet or exceed ASME B31 code and CSA standards for the temperature, pressure and fluid being introduced.
- Valves: Selected based on application (gate valves for positive close, globe for modulating applications, etc), 150# class on all steam and condensate piping. Rated for 100% capacity.
- Pumps: Selected based on application with attention to fluid, pressure, temperature, ft of head required, gpm requirement + safety factor, and space requirements.
- Heat Exchanger: Selected based on application, process fluid, control strategy to be employed, and capacity. Consideration shall be given to access for maintenance and cleaning and replacement of tube bundles. Design should allow for max capacity + 20% for fouling factor, or provide clean and dirty capacity.
- Steam Traps: Selected based on application. They shall be sized for full load capacity + flash steam (13%) + safety factor of 3:1. Traps shall be located 12" – 18" below unit, and every unit shall be equipped with a steam trap independent of any other. All steam traps installed on modulating systems shall be equipped with a vacuum breaker, and sized specific to the conditions imposed on it.
- Control Valves: Pressure reduction from 150 psig down to and including 12 psig shall be handled by a control valve that will be 60%-80% open during max flow, and 20% open at minimum flow.

- .1 Pressure-reducing stations shall consist of a pressure-reducing valve with 2-150# isolation gate valves, a bypass with a 150# gate valve isolator, 150# strainer, trap assembly appropriate for application with 2-150# isolation gate valves and an associated bypass line with a 150# gate valve isolation, pressure transmitter, pressure gauge with manual isolator. Please see Figure 1 for representative installation. Please note the pipe diameters upstream and downstream of the control valve and the flow meter shall be consistent with install recommendations supplied with the equipment.
- .2 The control valve shall be appropriate for the application, have the desired valve characteristics (linear, equal % or quick opening), be aligned with type, temp, viscosity, and specific gravity of fluid, accommodate min/max flow, temp and pressure, and meet the delta P requirements across the valve. If a pneumatic valve is chosen, ensure air supply is part of the design.

End of Section

23 33 00 Air Duct Accessories

Access Panels:

- .1 Provide access panels on walls, ceilings and ductwork to ensure that major mechanical equipment is readily accessible for servicing.

End of Section

23 33 14 Dampers – Balancing and Operation

Dampers:

- .1 Use quality hardware for balancing dampers to facilitate the balancing operation and to ensure positive locking of the damper.
- .2 Tamco Series 1000 shall be used for return air dampers. Tamco Series 9000 shall be used for outside air and exhaust air dampers. Opposed blade dampers shall be used for modulating service and parallel blade dampers for two-position service.
- .3 Blades on multi blade dampers not to exceed 200mm (8") in width and 1220 mm (48") in length

End of Section

23 33 16 Dampers – Fire and Smoke

- .1 All fire dampers shall be of a type and design to allow visual inspection.
- .2 Area in front of fire dampers must remain free of piping, ducting, etc. to allow access for maintenance.
- .3 Access doors must allow full servicing access to all fire dampers. Fire damper installation shall comply with ULC standards.
- .4 Spare fusible links to be provided.

End of Section

23 37 13 Diffusers, Registers and Grilles

- .1 Install ceiling air diffusers consistent with ceiling grids and are located in the centre of ceiling tiles where applicable. Exact location of any ceiling diffuser is to be as shown on architectural reflected ceiling plans.
- .2 Return air inlets shall be placed to prevent short-circuiting.
- .3 Round diffusers are preferred.
- .4 Do not use linear diffuser unless specifically approved by CUFMP.

End of Section

23 37 20 Louvers, Intakes and Vents

- .1 Louvers shall be equipped with bird screen, easily removed from the interior of the duct shaft. Consideration must be given to locate in area away from vehicle fumes and building exhausts (loading docks).
- .2 Dampers shall be Tamco or Rusco.

End of Section

23 40 00 HVAC Cleaning Devices

Access Panels:

- .1 Provide access panels on walls, ceilings and ductwork to ensure that major mechanical equipment is readily accessible for servicing

End of Section

23 74 00 Packaged Outdoor HVAC Equipment

- .1 For applications where an independent Roof Top Unit (RTU) will be installed, the preferred method is that the unit comes with a terminal strip that allows Carleton to operate the unit directly as opposed to an integrated controls package shipped with the unit.
Points that Carleton would control would include:
 - a. Fan (s) Start/Stop
 - b. Cooling Stages (Binary Outputs from BAS)
 - c. Heating Stages (Binary Outputs from BAS) or heating re-set signal (0-10 volts) if modulating
 - d. Economizer Control (Analog output from BAS)
 - e. Heat Wheel enable (if applicable)
- .2 The unit should have an 'economizer' option so 'free cooling' can be utilized.
- .3 Acceptable Manufacturers are as follows:
 - a. AAON
 - b. Engineered Air
 - c. Carrier
 - d. Other manufacturers will be acceptable if they can meet the above requirements and must be first approved by FMP.
- .4 Vibration isolation required.

End of Section

23 81 23 Computer Room Air Conditioning

Air Balance and Equipment Test (edit the following list to include all air devices on project which require balancing):

Include air handling units, fans, terminal units, fan coil units, room diffusers/outlets/inlets, computer room A/C units, student dorms A/C units, and laboratory fume hoods and cabinets.

- .1 Artificially load air filters by partial blanking to produce air pressure drop of at least 90% of the design final pressure drop.
- .2 Adjust fan speed to provide design air flow.
- .3 Test and balance systems in all specified modes of operation, including variable volume, economizer, and fire emergency modes. Verify that dampers and other controls function properly.
- .4 Variable air volume (VAV) systems:
 - a. Coordinate TAB, including system volumetric controls, with Delta control system.
 - b. Check and readjust air terminal unit rates if necessary (to factory specified min and max flow rates). Balance air distribution from ATU on full cooling maximum scheduled cubic meters per minute (cu ft. per minute). Reset room thermostats and check ATU operation from maximum to minimum cooling, to the heating mode, and back to cooling. Record and report the heating coil leaving air temperature when the ATU is in the maximum heating mode.
 - c. Record final measurements for air handling equipment performance data sheets.

End of Section

Division 25 – Integrated Automation

All new construction and renovation projects on Carleton University campuses are required to meet the Carleton University Facilities Design Guidelines. Including from the initial planning and design stages through to the various phases of construction and facilities maintenance and management. They are to mirror planning, design, construction, maintenance, and other facilities supporting University personnel. These documents are to be used as a guideline only on all Carleton University projects and are not to be used for bidding, permitting construction, or any other purpose. Any changes or substitutions must be approved by Carleton University Facilities Management and Planning (CUFMP) and must be submitted in writing. This document is the property of Carleton University. Any use of this document, in part or in whole, for purposes other than a Carleton University project cannot be done without written permission from the University.

Table of Contents

APPENDIX A..... 3

25 01 12 EMCS - Training 4

25 05 01 EMCS - General Requirements 5

25 05 03 EMCS - Project Record Documents..... 9

25 05 54 EMCS - Identification 10

25 10 01 EMCS - Local Area Network (LAN) 15

25 30 01 EMCS - Building Controllers 17

25 30 02 EMCS - Field Control Devices..... 18

25 90 01 EMCS - Site Requirements, Applications and Systems Sequences of Operation 23

25 99 99 - Energy Metering Systems..... 26

APPENDIX A

Controls Standards

Building Automation System (BAS) and Metering

Overview:

The Building Automation System (BAS) at Carleton University incorporates Delta Controls Inc. Direct Digital Control (DDC) equipment for monitoring and controls. It consists of PC-based Facility Management Stations (FMS) with color graphics, and data displays. DDC controllers interface directly with sensors, actuators and environmental delivery systems and components (HVAC systems, lighting systems, etc.).

The building automation system (BAS) is designed and enabled such that the Carleton University standards include building energy optimization techniques not limited to but that include:

- .1 Programmable scheduling of equipment start/stop times, night setback, morning warm-up and energy usage optimization.
- .2 Monitoring systems operation, allowing remote adjustments and providing necessary data logging and reporting functions.
- .3 Capability of interfacing with lighting controls to allow automatic lights on/off switching and scheduling as required.
- .4 Capability of interfacing with the fire alarm system to provide status and safe shutdown in case of fire.

To comply with the existing installations of the BAS at the University, it is essential that the new construction and renovation projects follow these standards and guidelines

25 01 12 EMCS - Training

Operation Personnel Orientation

Operations personnel training must be provided, as detailed in the project specifications, on all systems and components.

Orientation should be carried out as follows:

After commissioning of the new system and before sign off and acceptance, the Manager of Building Operations and Building Operations Technicians should be orientated in the proper operation and optimization of the system. This includes the sequence of operations, the system architecture, operations, and location of field peripherals. This training should also specify the design intent of the systems in place and an overview of regularly scheduled maintenance to ensure the systems are operating efficiently.

End of Section

25 05 01 EMCS - General Requirements

Design and Installation

Before any controls installation work on campus is carried out, (for a new building or a retrofit) a meeting will be held with all contractors involved in the installation of the Building Automation Systems, with the Manager of Building Operations and Project Managers assigned to oversee the work.

Equipment Access and Identification

- .1 Terminal and junction boxes used for low voltage control in the BAS must be clearly identified using orange covers.
- .2 Damper actuators must be installed to provide adequate room for removal of the actuator. A terminal block in an exposed junction box must be provided within two feet of the device to permit electrical testing and ease of maintenance.
- .3 VAV box controllers, damper motors and valves must be installed in such way that they can be easily accessed for maintenance and replacement without having to remove any building fixtures or obstructions. Pumps, coils, fans, valves, dampers, actuators and other system components must be installed in locations accessible for safe maintenance.
- .4 Humidifiers and dampers must have an adequate size access door that can be removed to enable visual confirmation that the equipment is functioning as specified and to be able to access the equipment for repairs and replacement.

Field Sensor Power Supplies

- .1 No more than 8 AI sensors (4-20mA) shall be connected on the same DC power supply.
- .2 Each controller must have a separate DC power supply.
- .3 Transformers (transformer 100VA 110VAC to 24VAC) must have 4A breaker and light on the secondary of the transformer. The secondary of the transformer (H2) must be grounded to the metal enclosure.
- .4 Transformers must not be ganged to each other.
- .5 The physical location of the DC power supplies and the 110VAC breakers must be shown on the as built drawings.
- .6 All power supplies must include a circuit board on which the electrical components reside, and the power supply units must be CSA approved.

Controls Programming and Commissioning

Distributed Control

- .1 All systems must employ fully distributed control.
- .2 All equipment in a mechanical room must be controlled by a computer based Delta controller in that room.
- .3 All points on one air-handling unit or system should be on the same controller so that I/O information does not have to be passed over a network.
- .4 Where a master/slave relationship occurs between 2 terminal LAN devices (i.e.: dual duct master/slave DAC/DVC) plastic identification tags must be fastened to the master and slave, indicating the master and slave device locations, LAN addresses and the location of the thermostats for the same.
- .5 The description field on the DAC/DVC must indicate the master/slave address.

Control Sequence

- .1 The control sequence supplied by the Engineer must be included in the graphic notes attached to the building graphics.
- .2 All changes are to be included in the notes and dated.
- .3 After commissioning, the original notes are to be placed on the server under the building as old notes and the latest as-built commissioned notes are to be attached to the building graphics.

Graphics

- .1 Individual graphics for each room must show all the points of the room controller.
- .2 All individual graphics must be linked to a master floor graphic display.
- .3 All floor graphics must be linked to a building graphic, which is linked to the campus graphic.
- .4 Each controller must have a controller graphic with the live data and the point descriptors for all the points linked to the controller.
- .5 All graphics and controller backups must be stored on a Carleton University server.
- .6 Please see attached example of the controller graphic.
- .7 Anything that is overridden must have red backfill in the box.

Control Software Design

- .1 There must be at least one separate input and one distinct output for each control function. For example, if there are three coils in a row in an air handling unit, there must be a separate sensor on the discharge of each coil and a separate 4-20mA (or 2-10VDC) output for each coil.
- .2 All interlocks or sequencing between the three coils must be implemented in the software.
- .3 Where applicable, graphic software feedback should be used to indicate the status of the mechanical system using descriptions such as “free cooling, flush mode, summer mode, holiday schedule or lo-space override”.

Point Names and Descriptors

- .1 See attached Point Naming Standards.
- .2 All controllers in the system must follow naming convention.
- .3 A points list must be submitted to the Manager of Building Operations or designate for approval prior to any entry being done in the controller or any hardware is installed in the field.
- .4 Once point names have been established, labels with the point names must be attached to the wire at the controller and the field device.
- .5 Every point on the controller, whether actual or virtual, must have a brief description of its function (purpose), remote location of device if not in a mechanical room and contact failed/alarm position.
- .6 Description for outputs must denote the voltage at 0% and 100% (100% represents open to the controlled device), the action type, NO/NC, AI's, the range and type, etc.

Controls Commissioning

- .1 Each analog output must be stroked to verify calibration, at 0%, 50% and 100% output values, before system programs are commissioned under the vendor's software.
- .2 All binary outputs must be put through a start/stop sequence.
- .3 A walkthrough with operating staff to demonstrate how the equipment is operated must be included in commissioning. The equipment installed, the sequence of operations, and location of controllers and other equipment should be thoroughly explained.
- .4 Variable Frequency Drives (VFD) operation shall be verified with all interlocks in auto and bypass mode.
- .5 VAV boxes: Flow min/max values, K factor (Kfact) for VAV flow must be in a separate program for the VAV.

- .6 There must be a demonstration (how and where the LAN has been run) to the Technical Services Controls Group staff when 5% of the installation of each RS485 LAN has been completed.

BACnet Devices

- .1 Manufacturers indicating that their product is BACnet compatible must prove the functional capabilities of a BACnet device as described in the Annex L of the BACnet Standard 2001. Annex L defines the specific “device profiles” or device types. We require a “BACnet Advanced Application Controller” (B-AAC). A device that is B-AAC requires certain capabilities (which are described in detail in the Annex K of the BACnet Standard 2001).
- .2 The B-AACs need to support the following:
 - a. Read values
 - b. Write values
 - c. Alarming
 - d. Scheduling
 - e. Receive time syncs
 - f. Be able to save the database

In other words the device is a B-AAC with MS/TP support to 76800 baud as a master device. Every BACnet device must support the full range of addresses which is a range of 0->4,194,302 (22 bits).

In addition, the product that is acceptable to Carleton must be BTL listed (ensuring that the product has been tested and is known to work). Alternatively, non-BTL product could be considered, but the supplier must provide the time and material needed to make the product work.

Mechanical Room Control Equipment

- .1 Field wiring shall be run to a panel containing color-coded terminal blocks mounted on a din rail. Wiring from this terminal block will run to another cabinet and terminating on the Delta Controllers. Analog I/O and Digital I/O will be wired to color-coded terminal blocks. Analog 4-20mA inputs should be wired as per diagram attached.
- .2 Transformers (transformer 100VA 110VAC to 24VAC) must have 4A breaker and light on the secondary of the transformer. The secondary of the transformer (H2) must be grounded to the cabinet. Transformers must be separated and shall not to be ganged to each other.
- .3 One transformer (24VAC) dedicated to Delta controllers in panels, one transformer for the AI's (4-20mA) and one or two transformers providing power to a damper actuator or a control valve actuator on the AHU.
- .4 CAT5 Cable should be installed in the Delta Controller cabinet to be able to plug in laptop computer. An electrical duplex plug must be installed in the control cabinet for laptop use.
- .5 Electrical panel/breaker supplying power to duplex plug must be clearly identified.
- .6 Condensate and sump high level alarms must be wired to BAS.

End of Section

25 05 03 EMCS - Project Record Documents

As-Built Documentation

Upon the completion of the installation of building automation systems equipment, digital copies of the As-Built Documents, duly signed by Automation Contractor (or Project Manager), must be handed over to the Manager of Building Operations or designate. These will contain, but not be limited to, the following:

- .1 Drawings with building floor plans showing the exact locations of all VAV boxes, fan-powered boxes, transformers and associated electrical panels and electrical breaker as well as all devices controlling the supply/return fans located on the floor.
- .2 Drawings showing all installed components, including fire and balancing dampers and their physical locations.
- .3 Separate drawing per building floor plan showing the network (LAN) routing to main controllers and LAN layout and addresses of VAV's and any other LAN connected devices (node) on the floor.
- .4 Drawing with building floor plans showing lighting panels, floor lighting distribution per lighting circuit and electrical power breaker feed for each lighting circuit.
- .5 Documentation will include network architecture, system layouts, system control diagrams, electrical diagrams, schematic drawings including Bill of Materials and identification of panel components. Technical sheets of all devices installed with exact models used should be provided.
- .6 The documentation must include Sequence of Operation.
- .7 Recommended spare parts list must be provided.
- .8 Point list of all DDC devices, electrical wiring diagrams of all devices to control fans, pumps, including wiring at Motor Control Centers and Variable Frequency Drives and location of wiring component distribution.
- .9 Air and water balancing reports must be supplied.

In addition to the above, contractor must provide three (3) electronic copies (using latest AutoCAD version).

End of Section

25 05 54 EMCS - Identification

Control Point Naming Standards

Each point name will consist of 4 or 5 fields separated by an underscore. They shall be as follows:

Building Name

Floor Level

System Name

Equipment Name (where required)

Point Function

Examples:

Start / stop supply fan AHU1: CS_03_AHU1_SF_SS

Temperature boiler 1: CS_03_BOILER1_T

Status Pump 1: CS_03_BOILER_P1_ST

Below is a list of Standardized Names:

SYSTEM NAMES		
ABBREVIATION	EXPLANATION	EXAMPLE
BOILER#	BOILER no.#	xxx_BOILER#_xxx_xxx
CHILLER	CHILLER	xxx_CHILLER_xxx_xxx
AHU	Air Handling Unit #	xxx_AHU#_xxx_xxx
CT	Cooling tower	xxx_CT_xxx_xxx
EF	Exhaust Fan	xxx_EF_xxx_xxx
HEX	Heat Exchanger	xxx_HEX#_xxx_xxx

EQUIPMENT NAMES		
ABBREVIATION	EXPLANATION	EXAMPLE
SF	Supply Fan	xxx_xxx_SF_xxx
P	Pump no.#	xxx_xxx_P1_xxx
HWHEEL	Heat Wheel	xxx_xxx_HWHEEL_xxx
SCR	SCR	xxx_xxx_SCR_xxx
DX	Direct expansion coil	xxx_xxx_DX_xxx
HV, CV	Heating Valve, cooling valve	xxx_xxx_HV_xxx
RF	Return Fan	xxx_xxx_RF_xxx
HUM	Humidifier	xxx_xxx_HUM_xxx

AIR TEMPERATURE SENSOR		
ABBREVIATION	EXPLANATION	EXAMPLE
EXHAT	Exhaust Air Temperature	xxx_EAT
LAT	Leaving Air Temperature	xxx_LAT
MAT	Mixing Air Temperature	xxx_MAT
OAT	Outside Air Temperature	xxx_OAT
PHAT	Pre-Heat Air Temperature	xxx_PHTAT
RAT	Return Air Temperature	xxx_RAT
SAT	Supply Air Temperature	xxx_SAT

LIQUID TEMPERATURE SENSOR		
ABBREVIATION	EXPLANATION	EXAMPLE
HWST	Hot Water Supply Temp	xxx_HWST
CWST	Chilled Water Supply Temp	xxx_CWST
HGST	Hot Glycol Supply Temp	xxx_HGST
DHWT	Domestic Hot Water Temp	xxx_DHWT
EWT	Entering Water Temp	xxx_EVAP_EWT / xxx_COND_EWT / xxx_HEX_EWT
LWT	Leaving Water Temp	xxx_EVAP_LWT / xxx_COND_LWT / xxx_HEX_LWT
EGT	Entering Glycol Temp	xxx_EVAP_EGT / xxx_COND_EGT / xxx_HEX_EGT
LGT	Leaving Glycol Temp	xxx_EVAP_LGT / xxx_COND_LGT / xxx_HEX_LGT
HWRT	Hot Water Return Temp	xxx_HWRT
CWRT	Chilled Water Return Temp	xxx_CWRT
GRT	Glycol Return Temp	xxx_GRT

HUMIDITY SENSOR		
ABBREVIATION	EXPLANATION	EXAMPLE
DEWP	Dew Point	xxx_DEWP
SAH	Supply Humidity sensor	xxx_SAH
OAH	Outside Air Humidity	xxx_OAH
RAH	Return Humidity sensor	xxx_RAH
EAH	Exhaust Humidity Sensor	xxx_EAH

DAMPERS		
ABBREVIATION	EXPLANATION	EXAMPLE
SAD	Supply Air Damper	xxx_SAD
EAD	Exhaust Air Damper	xxx_EAD
MAD	Mixing Air Damper	xxx_MAD
OAD	Outside Air Damper	xxx_OAD
RAD	Return Air Damper	xxx_RAD (normally not used)

PROTECTIONS		
ABBREVIATION	EXPLANATION	EXAMPLE
LL	Temperature Low Limit	xxx_LL
LLVL	Low Level	xxx_TANK_LLVL
HL	High Limit	xxx_SAT_HL, xxx_SAH_HL
HLVL	High Level	xxx_TANK_HLVL

LIGHTING		
ABBREVIATION	EXPLANATION	EXAMPLE
LIGHT	Lighting	xxx_Ryyy_LIGHT_SS

PRESSURE		
ABBREVIATION	EXPLANATION	EXAMPLE
DPSW	Differential Pressure Switch	xxx_DPSW
SPSW	Static Pressure Switch	xxx_SPSW
DSP	Discharge Static Pressure	xxx_DSP
BLDGSP	Building Static Pressure	xxx_BLDGSP
OAP	Outside Air Pressure	xxx_OAP
EOLSP	End Of Line Static Pressure	xxx_EOLSP
FLTP	Filter Pressure	xxx_FLTP
PFLTP	Pre-Filter Pressure	xxx_PFLTP
RSP	Return Static Pressure	xxx_RSP
SP	Static Pressure	xxx_SP
DP	Differential Pressure	xxx_DP

ROOM CONTROL VAV		
ABBREVIATION	EXPLANATION	EXAMPLE
BB	Electrical Base Board	xxx_Ryyy_BB
RAD	Water Radiator	xxx_RyyyRAD
RHP_SCR, RHP_HV	Radiant Heating Panel	xxx_Ryyy_RHP
DMP_CL	Damper Closing	xxx_Ryyy_DMP_CL
DMP_OP	Damper Opening	xxx_Ryyy_DMP_OP
DPS	Differential Pressure Sensor	xxx_Ryyy_DPS
RMH	Room Humidity	xxx_Ryyy_RMH
RMT	Room Temperature Sensor	xxx_Ryyy_RMT
RMCO2	Room CO2	xxx_Ryyy_RMCO2
HCV, CCV	Heating Coil Valve, Cooling Coil Valve	xxx_Ryyy_HCV, xxx_Ryyy_CCV (for duct coil)
PHV	Perimeter Heating Valve	xxx_Ryyy_PHV (should not be use)

ELECTRICAL INPUTS		
ABBREVIATION	EXPLANATION	EXAMPLE
AMP	Amperage	xxx_AMP
ELEC_SHED	Electrical Shedding	xxx_ELEC_SHED_SS
ELEC_ENT	Electrical Entrance	xxx_ELEC_ENT
KW	KiloWatt	xxx_KW
KWH	KiloWatt/Hour	xxx_KWH
READ	Reading	xxx_READ
AMP	Amperage	xxx_AMP
ELEC_SHED	Electrical Shedding	xxx_ELEC_SHED_SS

ACCESSORIES		
ABBREVIATION	EXPLANATION	EXAMPLE
FFH	Forced Flow Heater	xxx_FFH_SS
UH	Unit Heater	xxx_UH_SS
COMP_AIR	Compressed AIR network	xxx_COMP_AIR
FIRE_AL	Fire Alarm	xxx_FIRE_AL
INT_AL	Intrusion Alarm	xxx_INT_AL
AUTO	Automatic	xxx_AUTO
BURN	Gas Burner	xxx_BURN_SS / xxx_BURN_MOD
BP	By-Pass	xxx_BP_SS
DEF	Defrost	xxx_DEG_SS
MD	Motion Detector	xxx_MD
HEX	Exchanger for cooling or heating	xxx_HEX_ST...
GAS_CO2	Gas CH4, CO, CO2, NO, NO2 ... etc.	xxx_Ryyy_GAS_CO2 / xxx_RF_GAS_CO2
GEN	Generator	xxx_GEN_SS
OIL	Oil	xxx_OIL_LLVL / xxx_OIL_HLVL
ES	End Switch	xxx_OAD_ES
FIRE	FIRE	xxx_FIRE
PL	Pilot Light	xxx_PL_SS
PERM	Permission	xxx_PERM_SS
SUMP_PMP	SUMP Pump	xxx_SUMP_PMP_SS
RECIR	Recirculation	xxx_RECIR_PMP1_SS
STEAM_NET	STEAM Network	xxx_STEAM_NETSP
Ryyy_PTRAP	P-TRAP for Room xxx	xxx_Ryyy_PTRAP_AD
SOL	Solenoid	xxx_SOL_OC
VEL	Velocity	xxx_SF_VEL / xxx_EF_VEL
VTX	Vortex	xxx_SF_VTX_MOD / xxx_EF_VTX_MOD

End of Section

25 10 01 EMCS - Local Area Network (LAN)

Local Area Network (LAN)

- .1 There are two different options to connect new buildings or retrofits to the BAS. One is through the Delta Network and one is through Information Technology Services (ITS). The decision of which network the building or retrofit is utilized will be identified by Facility of Management and Planning. The precise connection methodology will be established by FMP.
- .2 All fiber optic LAN's must comply with multi mode Fiber 62.5/125UM.

LAN Control and Wiring

- .1 For Renovation Projects it is expected that the following standards for low voltage wiring apply.
- .2 For New Construction Projects the use of Power over Ethernet (POE) shall be explored with personnel from FMP.
- .3 All wiring must be properly supported (i.e. cable trays or conduits).
- .4 Low voltage wiring should be routed in separate conduit from the power cable conduit of 110 VAC and higher.
- .5 All sub-LAN's (RS485) should have their addresses starting from the lowest number, on a controller located physically closest to the master controller, to the highest number which is physically farthest from the master controller. This sequential numbering facilitates the troubleshooting process.
- .6 All controllers should be connected in sequence, i.e. LAN input for controller 33 should come from the LAN output of controller 32 and the LAN output of controller 33 must go to the input of controller 34. If sequential numbering cannot be followed then the next available number range shall be used. A network LAN layout shall be submitted with all controllers identified. This is to facilitate troubleshooting.
- .7 All controllers must be tagged at the controller indicating the controller address, the controller name, the electrical panel name/number, and the breaker number for the controller power transformer.
- .8 The ceiling panel or T-bar must be tagged with a small round orange tag with clearly printed controller address on it.
- .9 The controller name must contain the room number where the thermostat is located. If more than one thermostat is connected to the controller, then the controller name must indicate both room numbers.
- .10 All information must be shown on the as-built drawings and documented in the descriptor for that DAC. A 45 is to be the highest address on the sub LAN of any master controller (this will allow for 5 future controllers making 50 the maximum number of nodes on the network). If

there are more than 50 devices on the network, then another ethernet controller must be added to extend the network. The new controller must be installed in an enclosure located in a room (electrical or IT room) on the floor where the first controller is to be connected. The sequential addressing will again start at

- .11 Repeaters are not a preferred option to be used. If repeaters are deemed necessary, prior approval is required from FMP.
- .12 End-of-line terminators must be home run to the same panel that the master controller is in and installed in that panel.
- .13 Every DAC power transformer must be tested such that the +24V terminal of the DAC indicates 24 volts to ground.
- .14 The live 24V wire must be a red wire.
- .15 The grounded side of the 24V transformer must be a black wire.
- .16 FMP/Carleton prefers the use of Cerco #7586 (yellow jacket) 1 pair red and black #18-gauge.
- .17 All DAC's must be easily accessible i.e.: either externally mounted or an access door must be provided in the ceiling or wall to facilitate access. The same applies to lighting controllers.
- .18 All input/output wiring to the controller and wiring from the controller to the field device must be labeled.
- .19 Each floor that has a MSTP-LAN must have a minimum of two service ports at floor height to facilitate troubleshooting.
- .20 All controls equipment installed on campus must be installed and wired according to the latest version of the Delta Controls Wiring and Installation Guidelines. Special care should be applied to the grounding of the individual system components and of the total system.
- .21 Networking in a retrofit application - it is acceptable to insert a new DAC controller in an existing MS/TP network in a non-sequential manner provided that the following protocol is observed:
 - a. Modifications to the existing network layout are reviewed and approved by FMP
 - b. The new controller is properly tagged and identified
 - c. The new controller location is easily identifiable from the name
 - d. LAN layout drawings for the floor are updated to accurately reflect the actual location of the added controller on the network wiring layout
- .22 Before any controller (s) can be added to the network they must be flashed to the current firmware build. All necessary naming, configurations, addressing and network numbers for all available ports (regardless if used or not) must be correctly applied to the controller (s) being added. If any data exchanges are necessary, they must be set-up, configured, and programmed

in such a way where every attempt has been made to minimize traffic on the network. If adding a new building or multiple controllers the entire new segment must be verified and tested locally to be fully communicating and free of any network conflicts before they can be added to the network. For an example refer Figures on pages 35 and 36 of this documents of the four figures depicting a typical DSC-E with no link net.

End of Section

25 30 01 EMCS - Building Controllers

Acceptable Controller Models

- .1 For uniformity, spare parts, and ease of maintenance, Delta Controllers are to be used at Carleton University. All controllers to be used at Carleton are to be reviewed at the design meeting and approved by FMP prior to installation.
- .2 Any Delta Field Modules (DFM) application must be approved by the Manager, Building Operations.
- .3 DAC's on VAV's must have analog outputs only.
- .4 For Renovation Projects thermostats must be DNS 24L (BACstat II) or better.
- .5 For New Construction Projects thermostats must be DNS 24 or better with capabilities to monitor different sensors from temperature, humidity, motion and carbon dioxide levels.
- .6 System Controllers, installed in mechanical rooms, must have a reasonable (~20%) spare capacity of inputs and outputs for future expansion.

Controllers Enclosures

- .1 Main HVAC Delta Controllers in mechanical rooms shall be mounted in hinged enclosure, size 24" w x 36" h x 7" d (EEMAC/NEMA Type 1 Model 1100-362407) with a removable interior back plate. Panduit will be used to house wiring inside the enclosure.
- .2 Single Delta Controllers shall be mounted in hinged enclosure, size 24" h x 24" w x 7" d (EEMAC/NEMA Type 1), with removable interior back plate. Panduit will be used to house wiring inside the enclosure.
- .3 Exception will apply to field terminal applications controller and a controller on a VAV box.

Controllers Software

1. Delta controllers connected to the BAS must have the same software revision as the existing Delta network or ITS Network.

End of Section

25 30 02 EMCS - Field Control Devices

Actuators

- .1 Actuators must be specified to provide fail-safe control of dampers and valves in HVAC systems.
- .2 Actuator sizing should be done by supplier in accordance with the damper manufacturer's specifications.
- .3 Actuator size shall be based on the damper size and shall control only the maximum damper size specified.
- .4 Actuators and linkages have been known to fail when large dampers are used. Dampers should be no larger than 25 square feet to rectify this problem unless they can be properly controlled.
- .5 The actuator must provide proportional control output in response to a 2 to 10 VDC, 0 to 10 V or, with the addition of a 500 Ohm resistor, a 4 to 20mA control input from an electronic controller or positioner.
- .6 Actuators must use a brushless DC motor controlled by a microprocessor and be protected from overload at all angles of rotation.
- .7 A 2 to 10 VDC feedback signal shall be provided for position feedback or master-slave applications.
- .8 Carleton University will accept actuators from Delta Controls, Belimo, Elodrive and Siemens, and TAC/Schneider Electric.
- .9 Preference will be given to products sold and/or fully supported by Delta Controls Inc.
- .10 Actuators shall be UL listed and CSA certified. Installation and wiring must be done according to manufacturer's recommendations.
- .11 Pneumatics to be installed must be approved by Manager Building Operations or designate.
- .12 Piggyback installation of damper actuators is not acceptable.

Analog Outputs

- .1 Analog output devices signal must be 0-10VDC or 4-20mA.
- .2 All radiation heating valves and hot-deck VAV operators are to be normally open (NO) when power is removed from the device (when de-energized).
- .3 All analog outputs must be able to be manipulated from the graphic or by an operator command to the full range from 0-100%. For clarification, the 100% shall always represent full output for the expected function; (valve position for maximum cooling on cold deck represents 100%).

Division 25 – Integrated Automation

- .4 Valve position for maximum heating on hot deck represents 100% and open position of outside air dampers for mixed air equals 100% since it would normally be a function of cooling requirements.
- .5 VAV box actuators, actuators on terminal reheat coils do not require spring return.
- .6 Heating valves (NO) and cooling valves (NC) as well as damper actuators on air handling equipment must return to fail safe position.
- .7 Perimeter valves must return to a fail-safe normally open position when power is removed.

Electronic to Pneumatic Transducer

- The electronic to pneumatic transducer (I/P) receives a 2-10 VDC or 4-20mA signal and produces a 3-15 psig pneumatic output signal to position damper or valve actuator.

Duct Air Flow Meters / Static Pressure Sensors

- .1 Transmitter and tubing must be tagged at the physical location and indicated on a floor plan that is submitted with as-built drawings and manuals.
- .2 Transmitters shall be mounted at the sensor location.
- .3 DAC onboard airflow sensor and VAV airflow stations must have rubber tubing 3-4" long on their connections.
- .4 The ¼" plastic tubing for high/low signals shall run from the DAC to the air flow station and be inserted into the rubber tubing connections.

Freeze Protection

- .1 Freeze stat (TAC TC-5242) will be provided with a double set of contacts. One set of contacts will be hard-wired to the supply fan safety circuit. The other set of contacts will be wired as an input to the controller of the BAS.

Controls Wiring in Motor Control Centre (MCC)

- .1 All safety trips to be individually terminated and clearly identified in the motor control center. Use of stranded wire is the required standard.
- .2 Color-coding must be followed by using red for fire, blue for freeze, and orange for condensate.

Transformers and Power Supplies

Carleton University installations use 100VA transformer, 110VAC to 24VAC with a 4A mini breaker and indication light on the secondary side (power indication light will be off when the breaker is tripped).

- .1 If individual 40VA transformers are used for individual room controller, a breaker or fuse holder must be installed.

- .2 Power supplies will be 24 AC to DC, half wave rectified and fused.
- .3 Acceptable manufacturer for the 24 Volt AC is Marcus.
- .4 DC Power supply will be Greystone Model PS 1101.

Temperature Sensors

- .1 Use of thermistors (10k at 25C), in room thermostat sensor applications on a Dual Duct VAV or on a single VAV box will be acceptable if pre-approved by FMP. Acceptable thermistors must have accuracy within 0.2C over the full range for the application. Standard Room Temperature sensor is Delta Controls RTS400-1 or RTS400-2.
- .2 For pipe temperature-sensing applications, immersion well type devices are preferred. If immersion well cannot be accommodated then the strap-on type device will be acceptable.
- .3 Averaging sensors should be used for mixed air or if a sensor is mounted between two coils.

Temperature Transmitters

- .1 Transmitters must be 4-20mA (or 1-5 volts if pre-approved).
- .2 Components and circuit boards must be coated for moisture resistance conformity.
- .3 Supply voltage of 24 VDC.
- .4 Transmitters must have an integral zero and span adjustment. Initial calibration of +/- 0.2% of span.
- .5 Warm-up drift +/- 0.1% of span maximum.
- .6 Acceptable manufacturers are Delta Controls and Minco
- .7 Temperature transmitter ranges:
 - a. Immersion Hot Water: 0C - 100C
 - b. Immersion Chilled Water: -17C - 25C
 - c. Duct Hot Deck: 0C - 100C
 - d. Other Duct Transmitters: 0-50C
 - e. Outside Air: -50C to +50C

Pressure Transmitters

- .1 Transmitters must be 4-20mA (or 1-5 V if pre-approved).
- .2 Components and circuit boards must be coated for moisture resistance conformity.
- .3 Supply voltage of 24 VDC.
- .4 Transmitters must have an integral zero and span adjustment. Initial calibration of +/- 0.2% of span.

- .5 Warm-up drift +/- 0.1% of span maximum.
- .6 Acceptable manufacturer is Setra Systems Inc.
- .7 Wet Pressure transmitters for flow or differential pressures sensors across a pump must have isolation and equalizing valves. This is to ensure that testing and commissioning can be completed.

Carbon Dioxide (CO2) Gas Transmitters

- .1 To sense the concentration of carbon dioxide (CO2) in air, it is proposed to use the Delta self-calibrating carbon dioxide sensor which is a dual beam NDIR technology.
- .2 Analog outputs - CO2: 0-10 VDC factory set, 4-20 mA, 500 Ohms max., selectable, polarity protected.

Variable Frequency Drives (VFD's)

- .1 Acceptable Variable Frequency Drives manufacturers are: Danfoss.
- .2 Variable Frequency Drives must be installed according to the manufacturer's guidelines and shall have the following control and feedback points:
 - a. Binary inputs
 - b. Fault of drive
 - c. Fan/pump on drive/engaged monitor/ Bypass monitor
 - d. Binary outputs
 - e. Fan start/stop
- .3 Analog Inputs:
 - a. Current Donut feedback 1-5 Volts to indicate the motor current in Drive or By-pass
 - b. Fan Speed Monitor (1-10 Volts)
 - c. Pressure feedback for PID (4-20mA/1-10V) for Supply/Return Fan or Pump
- .4 Analog Outputs:
 - a. Pressure Set Point (0-10 Volts) for Supply/Return Fan Duct Pressure Control or Water
 - b. Differential Pressure Control
 - c. For a single VFD the points will be connected to a DAC-1146, and for a dual VFD system the points will be connected to a DSC-1616E

VFD Control Design Intent

- .1 All Digital Inputs, Analog Inputs and Analog Outputs must be capable of using the common ground of the dedicated BAS controller used to control both drives.
- .2 The PID control is to be done in the BAS. The controlled variable (static pressure) input must be available for local indication on the VFD display. Safety control parameters (ramp up/down, etc.) must be set by the VFD supplier to protect the drive or motor due to any control fluctuation by the BAS controller.
- .3 The VFD display must be backlit.
- .4 Bypass and auto switching capability must be provided and mounted on the front panel of the VFD controller.
- .5 Capability to open the front door panel while the drive is running must be provided.
- .6 Fault lights should be mounted on the front panel.
- .7 A terminal strip for all BAS connections to the drive must be available on the inside of the front panel of the drive. Start relays (low voltage) for the BAS to be mounted on the outside of the VFD drive panel in a separate junction box. A field wiring diagram, indicating all terminal block connections for the BAS connections, must be inserted inside the VFD panel in addition to being included in the as-built documentation.
- .8 All external trips such as freeze protection and fire protection will be wired as external lockout to the VFD and will not be wired to the Motor Control Centre breaker feeding the VFD.
- .9 All VFD control wiring to the Delta controller must use shielded cable and the shield must be grounded at the controller and not grounded at the VFD panel.
- .10 Speed and Feedback on BAS must indicate the actual speed of pump/fan regardless of any minimum speed, or offset parameters.

End of Section

25 90 01 EMCS - Site Requirements, Applications and Systems Sequences of Operation

Fan/Pump Operation

- .1 Indication of pump/fan/chiller operating status will be obtained with the installation of current sensor model Hawkeye H922 (split core donut with 0-5 Volt output).
- .2 Commissioned running and full load currents must be entered in the point descriptor.
- .3 Binary Value (BV) is to be programmed at 20% below the normal running value to indicate "ON" and the shutdown mode values to be programmed at 10% above the motor not running value to indicate "OFF".
- .4 For smaller size motors on pumps and fans that do not have an MCC starter, a current sensor model Hawkeye 548 device must be installed in conjunction with a built in HAND/OFF/AUTO switch. (The Hawkeye 548 has a built in Hand/Off/auto switch).
- .5 All stop/start relays must be 24 VAC control for DAC outputs and 10 VDC for DSC output and installed outside the starter cabinet, in an intermediate metal panel/box wall mounted (CSA approved) with hinged cover; located between the BAS controller panel and the Motor Control Centre. Ontario Hydro approval of the enclosure is required when the Stop/Start relay housing box is wired.
- .6 All starters must have a HAND/OFF/AUTO selector switch configured in the circuit. In the HAND/AUTO positions all interlocks and overloads must remain operational in the control circuit. In the HAND position the computer output control signal is overridden.
- .7 Safety Devices (fire and freeze) must be implemented with hardware devices and hardwired directly to the fan/pump MCC (or to the fan/pump VFD safety circuit) as opposed to being a programmed software application.
- .8 Safety devices must be installed directly in the medium, which must be monitored, loss of control of which could lead to serious system component damage (freeze protection must be installed in the mixed air stream).
- .9 All low voltage (0-24V AC/DC) wiring must be tagged and identified by nomenclature approved by Manager, Building Operations or designate. The contractor must submit the same for approval prior to commencing the wiring.
- .10 All wires and terminal blocks must be properly labeled and all wire splices, in the control wiring system loop, to be connected on marked terminal strips only.
- .11 Interlock programming must be assigned the highest priority in the programming, commissioning and testing phase.

- .12 All hardware safeties are to be checked and confirmed first in the program and confirmed that if a freeze/fire is in a state of alarm, the outputs are set such that the rest of the program cannot continue to be processed. This is to prevent the situation where a binary value (BV) fan status is overridden in error and the dampers open under winter freeze conditions.
- .13 All interlocks must function whether the controlled device of fan/pump operation at Motor Control Centre (MCC) is set either in Automatic or Manual mode.

Fire Alarm

- .1 The building fire alarm is monitored through the Department of University Safety (DUS). The signal from the building fire alarm panel shall be a binary input, and indicate as an alarm event on the DUS operator console.

Chiller Status

- .1 To pick-up the status of the chiller an analog current donut must be used.
- .2 At a minimum, the chiller must have the ability to reset the chilled water supply temperature, contact for chiller alarm and contact for Start/Stop of the chiller. A BACnet device shall be used to monitor all relevant points.

Packaged Air-Handling Equipment

- .1 All HVAC control components used on the roof-top unit must be hermetically sealed.
- .2 The roof-top unit control of the supply and return fans, heating, mixed air dampers, and DX cooling must be wired to and directly controlled by a Delta Controls DSC1616E controller.
- .3 Supply and return fans shall be controlled separately.
- .4 If Air Handling Equipment is provided with pre-packaged controllers, the controllers must be Delta.

Room Terminal Control Design Intent

- .1 No more than 4 VAV boxes are to be fed from the same low voltage power supply.
- .2 Transformers (transformer 100VA, 110VAC to 24VAC) must have 4A breaker and light on the secondary of the transformer.
- .3 The secondary of the transformer (H2) must be grounded to the cabinet.
- .4 Transformers must not be ganged to each other.
- .5 The location of all control transformers, electrical panel and breakers must be shown on the building floor plan and location as-built drawings.

- .6 Individual transformers will be 40VA, grounded secondary and have either a mini breaker or fuse associated with it.
- .7 All VAV boxes must be identified on the ceiling below the box.
- .8 As-built drawings must show VAV location and room numbers served by the VAV box.
- .9 All controller (radiation/reheat) actuators must be analog (range 2-10V output represents 0-100% device operation).
- .10 Radiation valves fail-safe position shall be normally open to the heating medium.
- .11 Actuators fail-safe position to be the valve's normally open position.
- .12 As-built drawings must clearly show radiation valve locations as well as the rooms that the radiation valve provides heat to.
- .13 Contractor must obtain written permission from Manager Building Operations or designate before removing existing sensors and valves or damper actuators.
- .14 If any existing pneumatic thermostat, valve, or damper is removed, the contractor must cap the copper main air and branch lines using compression fittings.
- .15 Electrical power for the Fan Powered Boxes (24VAC) must be separate and independent from those used for the Delta controller.
- .16 For troubleshooting purposes proper access must be provided to all controlled devices.
- .17 A properly sized current sensor donut must be installed on fan motor to provide run status information. Fan powered boxes, booster fans, or any fans located in the building or in the ceiling.

End of Section

25 99 99 - Energy Metering Systems

Overview:

The Carleton University metering system is used to measure all the energy used in each of the buildings on campus. Electricity, steam, domestic water, chilled water and gas consumption are captured from meters and pressure and temperature transmitters as needed. This information is then transferred to our Central Power Meter Monitoring System using the Schneider Electric Power Measurement ION 7550. The ION meter is connected to a proprietary network over cat5 cabling to a designated fiber switch. The fiber switch in turn has a dedicated fiber run to the main server room which is located in the Maintenance Building (Room 136A). There are other areas on campus where sub metering is implemented as well as the whole building energy.

The information below lays out the accepted manufacturers and models of all meters, sensors, switches and transmitters. Please note that if a substitute manufacturer or model is proposed it first has to be approved by the Manager of Building Operations.

Acceptable Meters Manufacturers and Models

Main Building Power Meter

PML 7550 ION power meter

Must be Ethergate

Must have Analog Input Card, 4-20mA

Meter is to be configured, addressed and commissioned locally

Cat5 must be run to designated metering fiber switch, home run on propriety network to the metering server room MB Rm.136A

Sub Metering

PML 7330 ION

Must have RS485 port

Must have Analog Input Card, 4-20mA

Must be connected in series with RS485 to the building 7550 ION meter

Note: All new electrical meters must be added to the metering software system, Schneider PME to include: Vista graphics, Designer, and EEM which includes setup for invoicing. This portion of the install will be done by a Schneider rep. onsite, or remotely by the Schneider rep. assigned to Carleton University under our support contract with Schneider.

Termination of ION Meter Requirements

Typically for building metering a 4-Wire Wye, 3 PT's Connection is used. All ION meters must be installed in a separate panel from the PT's. The meter enclosure will not have 600 volts within and a din rail mounted breaker will feed the 120 V to the ION meter. This isolates the ION meters from the 600 volts.

PT's, shorting blocks, and fuses for the PT's are to be in a separate enclosure. The wiring should be colour coded (red, red tracer, blue, blue tracer, etc...) or labelled with unique numbers. Knife switches

are used for the shorting blocks: States type SJK 60K10-ZD. Fuses: Ferraz Shawmut USFM Ultrasafe Fuse Modules, class CC 3 pole fuse module or equivalent. Cut sheet included in this documentation.

Please see Figure 1 for a typical installation.

Fiber Optic Switch

Manufacturer: ELinx, Model No.: EIR418-2SFP-T gigabit Ethernet switch.

DIN Rail Mount Power Supply, Manufacturer: Mean Well Model No.; MDR-60-24

Transceiver: Model No.; SFP-100FX-M-2KM-T

Cabling

- ION 7550
 - Cat 5 Cabling from switch to ION 7550
 - Note that the max distance from the ION 7550 to the switch is 300 feet.
- ION 7330
 - RS485 LAN wire (Belden 9463); OR
 - Allen Bradley Blue Hose TM shielded 300v cat#1770-CD

Steam Measurement

Steam flow and steam pressure is measured on the high pressure side of the building pressure PRV. The inputs for the steam flow, pressure and temperature shall be connected to the Analog Input card on the ION 7550. Steam flow is connected to the analog input one (AI 1) the acceptable units are m3/hr. AI 2 is for steam pressure (kPa) and AI 3 is steam temperature (C).

Steam Metering

Meter must be installed to the manufacturer's specifications and using the following specifications:

- Installed in the pipe with straight run of at least 20 pipe diameters upstream and 5 pipe diameters downstream from the meter.
- If there is no straight run easily available an E+H flow conditioner and 10 diameters upstream can be used.

Steam Pressure Transmitter

Manufacturer: Setra

Part# 5221010BG2M11E1F

Termination:

- 1 Pair of wire for Steam Pressure Transmitter to AI 2 on ION meter
- Requires 24volt Power Supply

Steam Temperature Transmitter

Minco 4-20 MA Transmitter and 100 ohm RTD Immersion Probe with well

Termination:

- 1 Pair of wire for Supply Steam Temperature Transmitter to AI 3 on ION meter
- Requires 24volt Power Supply

Domestic Water Metering

Requires twist lock receptacle (110 v)

Measurement for Domestic water flow (Litres / Minute)

Meter must be installed to the manufacturer's specifications.

Terminations:

- 1 Pair of wires for Instantaneous flow to AI 4 on ION meter
- 1 Pair of wires for Total Pulses to DI 1 on ION meter
- requires 24volt Power Supply

Domestic Water Meter

Manufacturer: Endress + Hauser

Model: Promag 50W Flanged Electromagnetic Flowmeter with Pulse option

For water above 60 Deg C. use Promag 50P (with PTFE liner)

Chilled Water Flow Metering

Measure chill water flow and both Chill water supply and return temperature

Requires twist lock receptacle (110v)

- 1 Pair of wires for Instantaneous flow to AI 1 on ION meter
- requires 24volt Power Supply

Chilled Water Flow Meter

Manufacturer: Endress + Hauser

Model: Promag 50W Flanged Electromagnetic Flowmeter with Pulse option

Chilled Water Temperature Transmitter

- requires 24volt Power Supply
- Minco 4-20 MA Transmitter and 100 ohm RTD Immersion Probe with well

Termination:

- 1 Pair of wire for Chill water Supply Temperature Transmitter to AI 2 on sub meter ION 7330
- 1 Pair of wire for Chill water Return Temperature Transmitter to AI 3 on sub meter ION 7330

If chilled water is supplied from another chiller plant in a different building, the amount of chilled water energy is calculated from using supply temperature, return temperature and the flow meter.

General Guidelines

- .1 All wiring shall be in conduit and control wiring shall be separate from power cabling (110 V AC and greater).
- .2 Equipment will be identified with mechanically fastened lamaroid plates with panel number, breaker number on site and identified on the as-built drawing.
- .3 The contractor is to provide a material list, electrical drawing and termination locations.

- .4 All meters are to be installed according to the meter Manufacturers Specifications.
- .5 All new meters are to be flanged.
- .6 All domestic water and chilled water meters are to be plugged into a twist lock receptacle.
- .7 All new meters are to have local indication. If a meter is obstructed by height, placement, or other objects a remote reader shall be used and mounted to the closest wall at chest height.
- .8 To implement metering into a new project or renovation site investigation is required. If an existing ION 7550 device exists in the building or close by in another building then it is possible that we can use the existing ION 7550 in conjunction with either an expansion card (model below) or by using an ION 7330 connected using RS-485.

Electrical Sub-Metering

- .1 When electrical sub-metering is identified as being required Advanced Meters shall be installed. The sub-metering strategy shall be approved prior by FMP before installation.
- .2 Advanced Meters shall communicate using MODbus protocol over serial or TCP networks.
- .3 The Advanced meter shall be compatible with and configurable for use with embedded HTML pages installed in Ethernet cards or gateways as part of the overall power monitoring and system network.
- .4 The Advanced meter shall be a Power Logic Power Meter PM800 series or approved equal.
- .5 The Advanced meter shall be installed on the feeder circuits as indicated.

End of Section

Division 26 – Electrical

All new construction and renovation projects on Carleton University campuses are required to meet the Carleton University Facilities Design Guidelines. Including from the initial planning and design stages through to the various phases of construction and facilities maintenance and management. They are to mirror planning, design, construction, maintenance, and other facilities supporting University personnel. These documents are to be used as a guideline only on all Carleton University projects and are not to be used for bidding, permitting construction, or any other purpose. Any changes or substitutions must be approved by Carleton University Facilities Management and Planning (CUFMP) and must be submitted in writing. This document is the property of Carleton University. Any use of this document, in part or in whole, for purposes other than a Carleton University project cannot be done without written permission from the University.

Table of Contents

Design Notes and Criteria 3

Power Distribution 8

26 00 00 – General Works..... 11

26 50 00 – Lighting 15

Design Notes and Criteria

Overview

- .1 This section has been prepared to provide consultants with a general overview of Electrical systems design requirements for new buildings and renovations in existing building.
- .2 Different team at the CU including CU's IT, Security and AV teams share the responsibility of programming and performance review of the various electrical disciplines along with CUFMP Integrated Project Delivery (IPD), CUFMP Operations (Ops); therefore consultants shall always review project requirements with respective teams to determine required information. All systems will be reviewed by CUFMP.

Design

Parameters

- .1 Design of electrical systems shall be flexible and expandable without significant modifications to the system infrastructure.
- .2 Design of electrical systems shall be done in such that the equipment and the systems to be able to operate in their maximum operation limit without causing any damage to the equipment and/or failure of the service.
- .3 Electrical equipment and/or components shall meet or exceed the energy efficiency requirements outline in ASHRAE 90.1-2010.
- .4 Design of Electrical Systems shall include the lowest life cycle maintenance cost and longservice life.
- .5 CU's preference is to reduce harmonics therefore followings shall be considered in design:
 - .1 Where high rated transforms are required consider to size high the neutral.
 - .2 For loads with significant third harmonic content neutral shall be doubled.
 - .3 For all circuit provide separate neutral conductor. Avoid sharing neutral in design.
- .6 In application such as laboratories, computer centers, substations where continuity of power isrequired, service shall be double ended.
- .7 Design shall include housekeeping pad for switch gears and MCCs.
- .8 Type, efficiency and temperature rise of transformers shall be consulted with CUFMP.
- .9 Low voltage transformers shall be dry type with 115°C rise.
- .10 Generally electrical rooms shall be ventilated without mechanical cooling. Review the designrequirements with CUFMP when mechanical cooling is required.
- .11 For future expansion requirements, design of subpanel distribution

- system shall minimize the distance between.
- .12 Locations of normal and emergency panels/subpanels shall be reviewed with Facilities.
 - .13 Design of main electrical distribution panels shall include 30% spare circuits. The spare circuits for other distribution panels shall be 20%.
 - .14 Aluminum cables are not permitted.
 - .15 Aluminum bus bar is not permitted.
 - .16 For renovation and new construction projects loads shall be balanced. Amperage shall be listed at the panel boards.
 - .17 Motors of 1 hp and above shall be 3-phase. Use of single-phase motor for fraction hp motors such as Fan Coil units are acceptable.
 - .18 3 Phase motors shall be premium efficiency to meet or exceed requirements outlined in ASHRAE 90.1-2010.
 - .19 All magnetic starters shall be equipped with Hand-Off-Auto controls, light test switches, running lights, reset buttons, auxiliary contacts and controls transformers. For protection motor circuit protectors shall be used, fuses are not permitted.
 - .20 Where VFDs are to be installed very close electrically to the incoming facility power source or in other locations within the electrical system where they will be otherwise highly susceptible to incoming spikes and other transients, the installation shall include additional measures for the protection of the front end/diode section of the drives such as a 3-5% line reactor. Line reactor(s) shall be appropriately sized and specified to suit the characteristics of the drive(s) and the electrical distribution system to minimize negative side effects.
 - .21 Where VFDs are to be installed in locations subject to harmonic distortion caused by nearby nonlinear loads, the installation shall include additional harmonic mitigation measures such as a DC link choke or 3-5% line reactor. Line reactor(s) shall be appropriately sized and specified to suit the characteristics of the drive(s) and the electrical distribution system to minimize negative side effects.
 - .22 VFDs shall be equipped with built in harmonic mitigation technology to minimize harmonic distortion and maintain system power quality.
 - .23 Where outdoor mechanical equipment with VFD(s) are used, VFDs shall not be installed inside the equipment. VFDs shall be installed in the closest mechanical or electrical room to the equipment.
 - .24 Where six or more starters are needed, MCC shall be provided.
 - .25 Where a main distribution panel is not used or available, MCC shall be used for distribution centers.
 - .26 Where elevators are fed from MCC, it shall have only breakers and not starters.
 - .27 Arc Flash, Short Circuit study and Coordination study shall be completed during design phase.

- .28 Where an existing Arc Flash study is available consultants shall modify the study for the final design. Where there is no existing study consultants shall perform their own study.
- .29 All equipment requiring Arc Flash study shall receive a permanent, durable Arc Flash Protection label as per code.

Installation and Maintenance

- .1 Provide adequate space for servicing, replacement and addition (for future projects) where equipment are installed in service rooms.
- .2 Electrical and communication equipment and/or components shall not be installed in mechanical service rooms unless required to service mechanical equipment.
- .3 Where electrical panels are installed in electrical rooms, closets and/or load centers, design and installation shall allow space for two additional panel boards for future projects/expansion.
- .4 Main ceiling mounted equipment, devices, sensors and components requiring readily service access and/or periodic maintenance and/or inspection shall be located, where possible in service rooms or and not over corridors.
- .5 Ceiling mounted equipment, devices, sensors and components requiring periodic maintenance and/or inspection shall be installed in such the installation provides ease of servicing access. The required maintenance and/or inspection work shall not jeopardize the health and safety of CU's operational staff and/or service contractors. They shall be accessible from the floor or a permanent service or access platform or walkway, standard step ladder or extension ladder.
- .6 All luminaries requiring re-lamping shall be accessible for service access. They shall be accessible from the floor or a permanent service or access platform or walkway, standard step ladder or extension ladder.
- .7 Wirings shall be identified with numbers on both ends of phase conductors of feeders and branch circuit wiring.
- .8 Wiring of controls, fire alarms and communication systems shall be colour coded and matched throughout in accordance with CU's standards.
- .9 Where conduits and/or cables penetrate walls, ceiling and floor, they shall be coded with plastic tape or paint at 3 m interval.
- .10 Equipment identification nameplates shall be Lamicoid 3 mm thick plastic engraving sheet, black face for normal power and red face for Emergency power, white core, mechanically attaches with self-tapping screws as below. For renovations, wordings and labels shall be reviewed and approved by CUFMP Operations Team.
- .11 Self-adhesive plastic labels with 6 mm high letters should be applied to all terminal devices. In renovations, wordings shall be reviewed and approved by CUFMP Operations Team.

- .12 Average of 25 letters shall be allowed per nameplate and label.
- .13 Nameplate of terminal cabinets and junction boxes shall indicate system and/or voltage characteristics.
- .14 Distribution equipment shall be identified by the nameplates.
- .15 Nameplate of Transformers shall indicate the capacity, power source, primary and secondary voltage.
- .16 Breakers, disconnects, starters and contactors shall be labelled indicating equipment being controlled and its voltage.
- .17 Receptacles shall be labelled indicating power source and circuit number.
- .18 Conceal conduits in finished areas.
- .19 Exposed conduits shall be run parallel to building gridlines. Maintain maximum headroom.
- .20 Outlets shall not be installed back to back where they are in the same wall or partition.
- .21 Minimum 150 mm horizontal distance shall be maintained between electrical boxes where they are in the same wall or partition.
- .22 Light switches and disconnect devices shall be located on latch side of doors.
- .23 Mounting height (from finished floor to centerline of component) of the electrical component shall follow below:

Switches	1,200 mm
Receptacles:	
General	300 mm
Over counters	175 mm
In service rooms, workshops, laboratories	1,200 mm
Panels (as per code or as indicated below):	
	1,800 mm from the top of the panel
	Where multiple panels are installed; align tops. Highest panel determines the height.
Voice and Data Outlets	300 mm
Phone outlets	1,400 mm
Fire alarm pull stations	1,400 mm
Fire alarm bells, horns, strobes	2,100 mm
Speakers	2,100 mm
Dry type transformers	2,400 mm
Time switches, lighting contractors	1,400 mm
Starters	
	1,500 mm from top
	Where multiple starters are installed, align tops. Highest starter determines the height

- .24 Following tests shall be conducted at time of completion and acceptance of work and reported in writing to CU for review and acceptance:
 - .1 Polarity, control and switches test circuits for correct operation of devices, switches and controls.
 - .2 Test voltage at last outlet of each circuit. Voltage drop shall not exceed the maximum allowance per Ontario Electrical Safety Code.
 - .3 Measure load on each phase at switchboards, splitters, distribution panels, lighting and power panels. Where necessary phase connections shall be rearranged to balance load on each phase. Loads shall be measured after rearrangement to confirm the load balance.
 - .4 Line voltage of each phase at load terminals shall be of main breakers shall be measured. Test shall be performed when majority of electrical equipment are in use.
 - .5 Line current of each phase of motors when motor is under load shall be measured.
 - .6 Insulation resistance (Megger) test for circuits, feeders and equipment shall be performed.
 - .7 Continuity of grounding and bonding conductors shall be verified.
- .25 At time of completion and prior acceptance of work test for loss and return of normal power of the following electrical systems shall be performed and reported in writing to CU for review and acceptance:
 - .1 High and low voltage equipment.
 - .2 Start-up of emergency generator and load transfer.
 - .3 Lighting controls and emergency lighting.
 - .4 Fire alarm and detection.
 - .5 Security access and intrusion alarm operation during power outage.
 - .6 UPS system.
 - .7 Communication system
- .26 All ground conductors shall be installed with non-metallic or non-continuous metallic hardware.
- .27 All ground bus connections shall be bolted lug type with double bolt.

End of Section

Power Distribution

General

Overview

- .1 This section has been prepared to provide consultants with a general overview of Electrical Systems design requirements for new buildings and renovations in existing building.
- .2 In many instances University undertakes short term planning and long term master planning to address economic and practical inefficiencies associated with renovations in existing building, therefore consultants shall always review project requirements. In all cases consultation with CUFMP will be required to determine the specific scope of work and requirements suitable to the project under review. All systems shall be reviewed by CUFMP.

Design

Parameters

- .1 Electrical rooms shall be located in such to maximize the flexibility of power distribution system and ease of access to floor area served.
- .2 Power distribution system shall be designed to provide flexibility and adaptability when change of spaces are required. Also ease of access to electrical panels shall be considered in the design to facilitate the addition of new feeds are required.
- .3 Central distribution panels shall be located close to load centers, such as mechanical rooms.
- .4 All panel boards shall be suitable for bolt-on breakers and be completed with copper bussing with full size neutrals for all distributions and branch panels with ground bus bonded to the panel board for bonding conductors.
- .5 Distribution system shall be designed with sufficient spare capacity to accommodate significant change of use.
- .6 Power distribution system shall be design to accommodate 30% spare capacity as a minimum at all nodes of the system for future growth.
- .7 Distribution panel, switch boards and panel boards shall be supplied by the same manufacturer.
- .8 Feeders to panels distribution panels, MCCs, etc. shall be TECK or RWZ(Z) XLPE copper conductors in rigid steel conduits and EMT. All feeders shall have the same ratings or larger than it's over load protection.
- .9 Indoor transformers shall be dry type, class 200 insulation and copper windings.
- .10 Computer server transformers shall be harmonic mitigation type.

- .11 Transformers shall be energy efficient meeting or exceed the requirements outlined in CSAC802.
- .12 Routing of distribution feeders shall be through common areas. Routing of distribution feeders between adjacent spaces which are subject to change is not acceptable.
- .13 Design of power distribution system shall minimize the arc flash hazard.
- .14 Design of power distribution system shall separate the lighting load from mechanical load for the purpose of metering and facilitate the measurement and verification.
- .15 Design of power distribution shall include the subdivision of the following categories:
 - .1 Normal lighting.
 - .2 Emergency lighting.
 - .3 Exterior lighting.
 - .4 Mechanical equipment.
 - .5 Electronic equipment and non-linear loads.
 - .6 Power feeds to rental spaces.
 - .7 UPS or emergency.
- .16 Consideration shall be given to control noise of electromagnetic fields in design of power system for noise sensitive areas. Electrical transformers shall not be located inside and/or adjacent to these areas.
- .17 All outdoor electrical cables shall be properly rated copper cables in underground duct bank complete with fully sized neutral.
- .18 All electrical conductors shall be copper.
- .19 Main switch boards shall be free standing with capacity and short circuit ratings to suit the specific characteristic of scheduled loads complete with 100% rated main circuit breaker and metering devices.
- .20 Design of 208/120V lighting panels shall include six, 15A/120V spare breakers as minimum.
- .21 Design of 600/347V power panels shall include two, 3 pole spare breakers as a minimum.
- .22 Design of all electrical panels (lighting and power) shall include 20% as a minimum additional space in addition to spare breakers.
- .23 Electrical equipment located in areas with sprinkler system shall be provided with water proof enclosure/protection against water from sprinklers acceptable to authorities having jurisdiction.
- .24 Where UPS system is used:
 - .1 UPS panel shall be completed with an isolated ground bus.
 - .2 UPS panel shall be located in UPS room.
- .25 For motors with 10 hp and larger (208V) and 30 hp and larger (600V) except for motors operating through VFD, reduced voltage or soft start starter shall be used.

- .26 All magnetic starters shall be equipped with Hand-Off-Auto controls, light test switches, running lights, reset buttons, auxiliary contacts and controls transformers.
- .27 For the purpose of protecting motors from loss/reversal or over/under current situations all three phase motors shall be equipped with phase protection devices.
- .28 Where motors are grouped (more than three) in an area, motor starters shall be grouped in MCC.
- .29 Motor starters shall be operated by the building automation system.
- .30 For motors 1 hp and larger single phase protection shall be provided.
- .31 Design main electrical room shall provide ground bus around the perimeter.
- .32 Grounding system shall be star configuration. Loop configuration is not acceptable.
- .33 Rooftop receptacles and receptacles in hallways and corridors shall be on their own branch circuits and not be powered from room branch circuits.

Installation and Maintenance

- .1 Conduits shall be grouped on channels.
- .2 Cables shall be run in conduits, ducts or wire ways.
- .3 Dry mount transformers shall be mounted on concrete pad with adequate clearance for ventilation.
- .4 At least one general purpose duplex receptacle shall be provided in electrical closets. In electrical rooms two duplex receptacles shall be provided as a minimum.
- .5 Motors with ½ hp and larger shall be three phase.
- .6 Lighting panels shall have minimum 60 circuit capacity.
- .7 In order to obtain better lagging power factor (better than 0.95) automatic power factor correction equipment shall be provided.
- .8 Single pole breakers with handle ties shall not be used in lieu of multiple breakers.
- .9 Recessed panels shall have two spare conduits from the panel to the ceiling for future use.

End of Section

26 00 00 – General Works

General

Design Criteria and Notes

- .1 Receptacle circuit identification:
 - .1 All receptacle covers shall be provided with a PTouch panel and circuit # identification label.
 - .2 Receptacles whose panel is supplied by an emergency power source shall be identified by a red color cover plate.
- .2 High voltage substations:
 - .1 Generally all Campus buildings are supplied from a 13.2 KV loop feeder with step-down transformers located within each of the Buildings.
- .3 Generators:
 - .1 Diesel fuel is normally utilized for emergency power sources.
 - .2 Where liquid cooled engines are required, a closed circuit glycol system is required.
 - .3 An automatic battery charger shall be provided to maintain the batteries at full charge, complete with adequate accessories. Charger shall have high/low charge rate and be capable of “floating” on the batteries at all times.
 - .4 Alarm indication resulting in shut down shall identify initial fault.
 - .5 The engine control panel shall incorporate a hand/off/auto selector.
- .4 Junction boxes: All existing junction boxes that are opened in the ceiling space shall have cover plates.

Products

General fixtures

- .1 Hallway service receptacles: Shall be of the industrial grade “T” slot type suitable for 120 volt, 20 amp circuits (housekeeping services).
- .2 GFI receptacles: CSA approved, ULC listed, Class A, c/w Test/Reset feature and Green/Red pilot lights, c/w stainless steel cover plate, white finish.
 - Suggested (or equivalent) Product: “GFST15W” (15 amp circuit), & “GFST20W” (20 amp circuit).

- .3 Electrical Panel: With the following characteristics:
 - .1 To keep a total of 20% available circuits (spare breakers and blank spaces) for future use.
 - .2 Provide around 10% of 15 amps spare breakers for future use.
 - Suggested (or equivalent) Product: “EZ box, PRL-1a”, including Bolt-on breakers, by Cuttler Hammer, with identification label “Lamicoid.” White letters on black label.
- .4 Motorized Projection Screen control: Projection screen motor shall have a new 2 Poles, 1HP, 230V, ON/OFF manual motor starter switch installed at proximities and capable of cutting both power up and power down.
- .5 Podium desk control: With the following characteristics:
 - .1 Podium-mounted momentary contact switch for projection screen shall be 20A – 120V, spring load three-position, single pole, double throw, center OFF, including stainless steel cover plate.
 - .2 All podium Electric Outlet shall be equivalent to the surge suppression duplex receptacles indicated.
 - .3 Lighting scenes shall be identified on the scene selector located on the podium lip
 - Suggested (or equivalent) Product:
 - .1 Scene selector: As manufactured by Lutron.
 - .2 Key switch controlling electrical outlet by-pass relay: “1221-2KL”, single pole by LEVITON.
 - .3 Electrical outlet by-pass relay: “BZ-100EP”, 120VAC, Featuring hold-on inputs, by WattStopper.
 - .4 Podium door operated contact switch: “1865”, momentary, metal push button, normally ON contact, by LEVITON.
- .6 A/V Electric Outlet: 120 Volt, surge suppression duplex receptacles, 15A-125V, “Commercial Specification” grade minimum, with stainless steel cover plates.
 - Suggested (or equivalent) Product: “HBL5260S” blue colour with stainless steel coverplate by Hubble.
- .7 Accessible Table outlets: Two simplex outlets per sphere, with the following notes:
 - .1 All blanks to be permanently capped.
 - .2 All electrical wires to be contained within a tamper proof raceway mounted on underside of table.
 - .3 All wires to be concealed in a suitable black liquid tight flexible conduit.
 - Suggested (or equivalent) Product: “Sphere” by Byrne Electrical.

- .8 Seats with retractable tablet outlets: The electrical distribution system shall be integrated in the design of the seating, to accommodate the requirements of laptop computers. The receptacle shall not interfere with the seat and tablet return. All wires and components shall be concealed with covers. The receptacle module shall be constructed of a vandal proof material and be both visible and accessible from a seated position.
- .9 Fixed table and Swivel Seat outlet: To have concealed wiring systems from power stub-ups at floor level to power monument on table top. Pedestal/base plate structure/seat to provide for the installation of power devices.
 - CU standard Products:
 - .1 For new tables: "Sphere" by Byrne Electrical.
 - .2 For existing tables: "VIRCO" could be used upon CUFMP approval.
- .10 Terminal Strip Box: With the following characteristics:
 - .1 All zones and electrical circuit shall be identified to all devices and terminal strip box.
 - .2 Provide wiring diagram on or inside terminal strip box cover.
 - .3 All Multi-Media wiring shall be inside EMT conduits.
 - .4 Only EMT conduits should be used.
 - .5 EMT conduits should incorporate ¼" diam. pull cord and be terminated at ends with a coupling and a plastic bushing.
- .11 Electric jet towel hand dryer, surface mounted: White color c/w new 15A-120V ground fault circuit interrupter breaker.
 - CU Standard product: "JT-SB116JH2", by Mitsubishi.

Laboratory Fixtures

- .1 **Monuments:**
 - .1 **Monument boxes in Stainless steel:** For electrical outlets, in Stainless Steel, 1.2 mm(18 ga) thick, delivered with galvanized rods, connectors, threaded nut washers, grounding rods and Stainless Steel receptacle covers.
 - **Suggested (or equivalent) products:** As manufactured by CIF:
 - .1 “SE004”, double face, single gang. Outlet to be supplied with duplex 20A receptacle with "T" slot.
 - .2 “SE006”, double face, Quadplex (double gang), with 20A receptacle.
 - .2 **Monument boxes in Coated Aluminum:** For electrical outlets, in epoxy powder coated finish, 6 mm thick, delivered with galvanized rods, connectors, threaded nut washers, grounding rods and Stainless Steel receptacle covers.
 - **Suggested (or equivalent) products:** As manufactured by CIF:
 - .1 “E300WS” or “E400WS”, single or double face as indicated, single gang. Outlet to be supplied with duplex 20A receptacle with "T" slot.
 - .2 “E500WS” or “E600WS”, single or double face as indicated, Quadplex (double gang), with 20A receptacle.

End of Section

26 50 00 – Lighting

General

Design Criteria and Notes

- .1 Preference shall always be given to higher rated lamp life.
- .2 Select fixtures models designed with ballast, lamp and lamp socket accessibility.
- .3 Where light fixtures are installed in gypsum board ceiling, specify appropriate frame from factory. Use of custom-made frame is not acceptable unless otherwise indicated.

Products

- .1 Florescent lamps: Type T8, with a CCT of 3500°K , in length of 4 or 2 ft, U shape (1 5/8" to 6" spacing).
 - Suggested (or equivalent) Product: "835" series by Sylvania.
- .2 Florescent Ballast: T8 type ballast with THD less than 20%, normal ballast factor of 0.87.
 - Suggested (or equivalent) Product: As manufactured by Sylvania Quictronic
- .3 Classroom Light: With the following characteristics:
 - .1 120V, 3-wire, c/w dimmable ballasts, HI-LUME 1%.
 - .2 On chalkboard light fixtures, the use of Compact SE 5% dimming ballast will be acceptable.
 - .3 10% dimming ballast are not acceptable.
 - Suggested (or equivalent) Product: Ballasts, as manufactured by Lutron.
- .4 Classroom Fluorescent Lamps: With the following characteristics:
 - .1 T8, 17W (or 32W), and provide 1400 (2900) lumen at 3500°K, have a triphosphor colour improved coating and operate with a 20 000 hour life rating.
 - .2 4 pin High Lumen Biax lamps, TT5, 40W, providing 3100 lumen at 3500°K will be acceptable for chalkboard light fixtures. Lamp shall operate with a 20000 hour life rating.
 - .3 For all fluorescent dimmable light fixtures, prior to first lamp dimming, provide a minimum lamp burning period of 100 hours at 100% lighting load.

- .5 Lighting & Emergency Light Controller: With the following characteristics:
- .1 Shall include external power supply when required by the manufacturer instructions.
 - .2. Emergency Lighting Controller (scene 16) shall be indicated to be pre-programmed by an electrician to have all emergency lighting zones on it. Emergency lighting circuit(scene 16) shall have a dual pole (open/close) contact to enable a closure interface to emergency power supply when there is a power failure.
 - CU standard Product: “GrafikEye”, as manufactured by Lutron.
- .6 Occupancy Sensor: Shall be connected to a contact closure interface controlling the Lighting controller, dual technology ceiling mount occupancy sensor.
- Suggested (or equivalent) Product: As manufactured by WattStopper.
- .7 Exit signs: Depending on electrical parameters and minimal lighting Codes requirements: Pictogram sign, Photoluminescent system, Zero energy consumption, surface ceiling or flagmount.
- Suggested (or equivalent) Product: “Ecolo Exit Signs” Series by Kinesik.
- .8 Wiring: System cable data line connected to Controller shall be separate from line voltage wiring by at least ¼” (7mm), to avoid functioning problems.
- .9 Task light: Mid-powered LEDs spaced uniformly for even distribution on the task plane: Evenglow diffuser, minimize shadow effects, easy to clean, 3500K colour temperature, with individual dimming to off on each luminaire, 565mm, 62.2 lumens per watt efficacy, 380 lumens light output, 6.1w power consumption, 60w power supplies to provide power up to 4 luminaires , 87 color rendering index, rated for 100 000 hours at 90% initial lumens, power cable from power supply to first luminaire, patch cables for daisy chaining luminaires (length according to furniture layout without excessive lengths), splitter cable for two rows of lights at the island, and extension cables as necessary. Can be used as stand also unit or daisy chained.
- Suggested (or equivalent) products: “UC-E-22-S-PS-60W” by Finelite

Street and Pathway Lighting – Design Guidelines

General

All exterior lighting fixtures shall be durable, energy-efficient LED luminaires suitable for campus use and compatible with Carleton University standards. Fixtures shall provide consistent illumination, minimize glare, and integrate with existing campus lighting aesthetics.

Pathway Lighting

Fixture Type: Pathway light

Standard: KIM Lighting – *Solitaire* series

Light Source: LED

Optic / Style: Acorn

Model: Refer to table below. Equivalent products will be accepted upon approval from Carleton University.

Application: Pedestrian pathways, walkways, and landscaped areas

Street Lighting

Fixture Type: Street light

Standard: Philips

Model: Refer to table below. Equivalent products will be accepted upon approval from Carleton University.

Application: Campus roadways and vehicular circulation areas

Type	Description	Local Lighting Representative
GF1	Ground Mounted Floodlight - (4600 lumens)	WSA (Acuity)
GF2	Ground Mounted Floodlight - (10,500 lumens)	WSA (Acuity)
GF3	Ground Mounted Floodlight - (4600 lumens)	WSA (Acuity)
FP1	Pole mounted Floodlight - (10,500 lumens)	WSA (Acuity)
FP2	Pole mounted Floodlight - (10,500 lumens)	WSA (Acuity)
LD	Large downlight - Vandal resistant	WSA (Acuity)
D16	Downlight 16"	WSA (Acuity)
DL4	Downlight square	WSA (Acuity)
DW	Downlight square	WSA (Acuity)
FL	Floodlight - Large	WSA (Acuity)
FM	Floodlight - Medium	WSA (Acuity)
LF	LED Strip	WSA (Acuity)
SM	Wall Sconce Medium	WSA (Acuity)
PJ2	Parking Garage Staircase 2ft fixture	WSA (Acuity)
PJ3	Parking Garage Staircase 2ft fixture	WSA (Acuity)

Type	Description	Local Lighting Representative
L2(MVOLT)	Philips Urbanscape - Roadway	Alland (Philips Rep)
L3(MVOLT)	Philips Urbanscape - Roadway	Alland (Philips Rep)
L5(MVOLT)	Philips Urbanscape - Roadway	Alland (Philips Rep)
L3 (347V)	Philips Urbanscape - Roadway	Alland (Philips Rep)
L5(347V)	Philips Urbanscape - Roadway	Alland (Philips Rep)
DL1	Square under canopy - Surface	Alland (Philips Rep)
DL2	Square under canopy - Recessed	Alland (Philips Rep)
DL3	Square under canopy - Recessed	Alland (Philips Rep)
W2(347)	Wallpack - medium lumen output (5000)	Alland (Philips Rep)
W2(MVOLT)	Wallpack - medium lumen output (5000)	Alland (Philips Rep)
W3(347)	Wallpack - medium lumen output (5000)	Alland (Philips Rep)
W3(MVOLT)	Wallpack - medium lumen output (5000)	Alland (Philips Rep)
W4(347)	Wallpack - medium lumen output (5000)	Alland (Philips Rep)
W4(MVOLT)	Wallpack - medium lumen output (5000)	Alland (Philips Rep)
Y2(347)	Wallpack - high lumen output (9000)	Alland (Philips Rep)
Y2(MVOLT)	Wallpack - high lumen output (9000)	Alland (Philips Rep)
Y3(347)	Wallpack - high lumen output (9000)	Alland (Philips Rep)
Y3(MVOLT)	Wallpack - high lumen output (9000)	Alland (Philips Rep)
Y4(347)	Wallpack - high lumen output (9000)	Alland (Philips Rep)
Y4(MVOLT)	Wallpack - high lumen output (9000)	Alland (Philips Rep)
Z2(347)	Wallpack - low lumen output (3500)	Alland (Philips Rep)
Z2(MVOLT)	Wallpack - low lumen output (3500)	Alland (Philips Rep)
Z3(347)	Wallpack - low lumen output (3500)	Alland (Philips Rep)
Z3(MVOLT)	Wallpack - low lumen output (3500)	Alland (Philips Rep)
Z4(347)	Wallpack - low lumen output (3500)	Alland (Philips Rep)
Z4(MVOLT)	Wallpack - low lumen output (3500)	Alland (Philips Rep)

Type	Description	Local Lighting Representative
CP	Curved surface downlight	WSA (Acuity)
S1	Sconce	Rab lighting
D12	circular surface mount downlight	Waterman (Eaton)
POLES	Replacmeent Poles	Dyna Pole
CONCRETE BASES	Concrete prefab bases	USI

Type	Description	Local Lighting Representative
SP1A (UNV)	Parking Lot - 20,000 lumens	BDA (Hubbell)
SP1A (347V)	Parking Lot - 20,000 lumens	BDA (Hubbell)
SP2A	Parking Lot - 9,000 lumens	BDA (Hubbell)
SP2B	Parking Lot - 15,000 lumens	BDA (Hubbell)
SP2C	Parking Lot - 9,000 lumens	BDA (Hubbell)
SP2D	Parking Lot - 9,000 lumens	BDA (Hubbell)
SP3A (UNV)	Parking Lot - 7,800 lumens	BDA (Hubbell)
SP3A (347v)	Parking Lot - 7,800 lumens	BDA (Hubbell)
SP3B	Parking Lot - 7,800 lumens	BDA (Hubbell)
SP3C	Parking Lot - 7,800 lumens	BDA (Hubbell)
SP4A	Parking Lot - 35,000 lumens	BDA (Hubbell)
SP4B	Parking Lot - 35,000 lumens	BDA (Hubbell)
SP5A	Parking Lot - 6,000 lumens	BDA (Hubbell)
SP5B	Parking Lot - 7,800 lumens	BDA (Hubbell)
SP5C	Parking Lot - 7,800 lumens	BDA (Hubbell)
K1 (UNV)	Kim Solitaire - Pathway Fixture	BDA (Hubbell)
K1 (347V)	Kim Solitaire - Pathway Fixture	BDA (Hubbell)
K2 (UNV)	Kim Solitaire - Pathway Fixture	BDA (Hubbell)
K2 (347V)	Kim Solitaire - Pathway Fixture	BDA (Hubbell)
K3 (UNV)	Kim Solitaire - Pathway Fixture	BDA (Hubbell)
K3 (347V)	Kim Solitaire - Pathway Fixture	BDA (Hubbell)
K4 (UNV)	Kim Solitaire - Pathway Fixture	BDA (Hubbell)
K4 (347V)	Kim Solitaire - Pathway Fixture	BDA (Hubbell)
K5 (UNV)	Kim Solitaire - Pathway Fixture	BDA (Hubbell)
K5 (347V)	Kim Solitaire - Pathway Fixture	BDA (Hubbell)
R1 (UNV)	Kim Solitaire Retrofit Kit	BDA (Hubbell)
R1 (347V)	Kim Solitaire Retrofit Kit	BDA (Hubbell)
R2 (UNV)	Kim Solitaire Retrofit Kit	BDA (Hubbell)
R2 (347V)	Kim Solitaire Retrofit Kit	BDA (Hubbell)
R3 (UNV)	Kim Solitaire Retrofit Kit	BDA (Hubbell)
R3 (347V)	Kim Solitaire Retrofit Kit	BDA (Hubbell)
R4 (UNV)	Kim Solitaire Retrofit Kit	BDA (Hubbell)
R4 (347V)	Kim Solitaire Retrofit Kit	BDA (Hubbell)
R5 (UNV)	Kim Solitaire Retrofit Kit	BDA (Hubbell)
R5 (347V)	Kim Solitaire Retrofit Kit	BDA (Hubbell)
RR (UNV)	Kim Solitaire Retrofit Kit	BDA (Hubbell)
RL (UNV)	Kim Solitaire Retrofit Kit	BDA (Hubbell)
RL (347V)	Kim Solitaire Retrofit Kit	BDA (Hubbell)
L1	LED Lamp - Tunnel	BDA (Hubbell)
L2	LED Lamp - Tunnel	BDA (Hubbell)

N2	New Kim Solitaire	BDA (Hubbell)
PG1	Parking Garage Fixture	BDA (Hubbell)
PG1S	Parking Garage Fixture c/w sensor	BDA (Hubbell)
PG4	Parking Garage - Top level post fixtures	BDA (Hubbell)
D6 (120V)	6" Canopy Downlight	BDA (Hubbell)
D6 (347V)	6" Canopy Downlight	BDA (Hubbell)
D8 (120V)	8" Canopy Downlight	BDA (Hubbell)
D8 (347V)	8" Canopy Downlight	BDA (Hubbell)
D10 (120V)	10" Canopy Downlight	BDA (Hubbell)
D10 (347V)	10" Canopy Downlight	BDA (Hubbell)

End of Section

Division 27 – Communications

TELECOM/IT ROOMS AND STRUCTURED CABLING SPECIFICATIONS

All new construction and renovation projects on Carleton University campuses are required to meet the Carleton University Facilities Design Guidelines.

Including from the initial planning and design stages through to the various phases of construction and facilities maintenance and management. They are to mirror planning, design, construction, maintenance, and other facilities supporting University personnel. These documents are to be used as a guideline only on all Carleton University projects and are not to be used for bidding, permitting construction, or any other purpose. Any changes or substitutions must be approved by Carleton University Facilities Management and Planning (CUFMP) and must be submitted in writing. This document is the property of Carleton University. Any use of this document, in part or in whole, for purposes other than a Carleton University project cannot be done without written permission from the University.

Please complete the attached checklist and record compliant items; if Non-Compliant or Not Applicable, then please provide supporting comments as to the reasons why the item may be Non-Compliant or Applicable.

Table of Contents

1.0 General..... 3

2.0 Structure Cabling..... 4

3.0 Connections to the campus network..... 4

4.0 Power 5

5.0 Cooling 6

6.0 University Data Centre..... 6

7.0 Sample Layout of Building Distributor 7

8.0 Grounding and Bonding 8

1.0 General

Summary

- .1 This document contains specifications required to build the telecommunication rooms (TR) and structured cabling infrastructure as part of New Building Project.
- .2 There will be one Building Distributor Room at Level 1, and Floor Distributor Rooms on each of the floors
- .3 Cat6 data drops will be installed for computer, VOIP phone, wireless access points, security camera, fire alarm panel, CBORD controller
- .4 The quantities and locations of the Cat6 data drops will be as defined by the building owners, Architects, and the floor plans provided by FMP project managers
- .5 Control cables for devices such as vending machines, washer, dryer, BAS etc. are normally excluded
- .6 Control cables can be included, at the request of the building owners and FMP project managers
- .7 Two fiber optic cables/uplinks to the main campus data network will be installed
- .8 Cabling works will be assigned to the preferred cabling contractors/vendors that were selected through the regular (every 5 years) Request for Proposal (RFP)

Definitions

- .1 Building Distributor room:
The building is the Entrance point into the building for all IT, telecommunications cabling, and equipment. This room will be the aggregation point for IT cabling coming from each floor, and a connection point to the campus Data Network. A minimum of one wall should be covered with a quantity of three (3) 4 feet by 8 feet X 3/4" thickness sheets of fire rated plywood. No suspended/false ceiling is required in this room. The Building Distributor room must be no less than 10'x10' in size
- .2 Floor Distributor rooms:
the primary purpose of these rooms is horizontal cable distribution. These rooms will house cable terminations, cross connects, and telecommunications equipment serving the floor . They are considered floor serving facilities, formerly called telecommunications rooms. These rooms should be stacked and connected via a minimum of 4 X 4" sleeves in the floors. A minimum of one wall should be covered with a quantity of one (1) 4 feet by 8 feet X 3/4" thickness sheet of fire rated plywood. No suspended/false ceiling is required in these rooms.
- .3 The Floor Distributor room must be no less than 10'x10' in size
- .4 The Floor Distributor and Building Distributor can be combined inside one room. In this case, the room must be no less than 10'x12' in size
- .5 Both the Floor Distributor rooms, and the Building Distributor rooms must be accessible from a public area (i.e. hallway)
- .6 Both the Floor Distributor rooms, and the Building Distributor rooms doors must be on the Card Access system

2.0 Structure Cabling

- .1 A Cable tray must be installed in the ceiling of each floor, and extend from the Floor Distributor room and span the length of the floor. The said cable tray will act as an aggregation trunk, and carry all cables coming from the data drops locations to the designated Floor Distributor rooms (Telecommunications rooms).
- .2 The Cable tray must be installed in the hallway, and must be of a closed type tray if it is in an exposed area.
- .3 The Cable tray must be 12" wide X 3" high.
- .4 The Cable tray must be installed in a manner that will allow unhindered access, serviceable, and not be obstructed by any other element
- .5 Each data drop, in all rooms and all locations, must have a one (1) inch conduit terminating in a 4"x4"x2.5" box with single gang plaster ring. This one (1) inch conduit must extend up to the ceiling and terminate in the above cable tray. A pull string must be left in each conduit.

End of Section

3.0 Connections to the campus network

- .1 A Minimum of 2 X 4 "conduits from the new building Main IT room (Building Distributor) on level 1 to the connection point on the campus Data network. These will be used for two fiber uplinks. The connection point to the campus data network will be determined in consultation with ITS network services group

End of Section

4.0 Power

Building Distributor Room

- .1 5-20RA receptacles must be distributed and installed at approximately 4' intervals, on each of the four walls of the Building Distributor Room. This can be one circuit.
- .2 A quantity of 2 X 5-20RA receptacles must be installed above the equipment rack inside the Building Distributor Room. Each of these receptacles will be terminated to a separate 20A electrical circuit. These circuits must be on Emergency Power
- .3 A quantity of 1 X 6-50R receptacle must be installed on the wall in close proximity to the equipment rack inside the Building Distributor Room. This circuit must be on Emergency Power. Exact location of this circuit will be determined in consultation with ITS- network services at time of install
- .4 2 dedicated 30A at 120 volts circuits terminated in twisted L5-30R, and 4 dedicated 30A at 208/240 volts emergency power circuits terminated in twisted L6-30R
- .5 Fluorescent lamps must NOT be installed above the racks. (see attached **sample** layout at end of this document)
- .6 Install ground bars in the Building Distributor room (see specifications for telecommunications system bonding at end of document)

Floor Distributor Rooms

- .1 5-20RA receptacles must be distributed and installed, at approximately 4' intervals, on each of the four walls of the Floor Distributor Room. This can be one circuit.
- .2 A quantity of 2 X 5-20RA receptacles must be installed above the equipment rack inside the Floor Distributor Room. Each of these receptacles will be terminated to separate 20A electrical circuit. These circuits must be on Emergency Power
- .3 Fluorescent lamps must NOT be installed above the racks, but offset. (see attached table)
- .4 Install ground bars in each Floor Distributor room, on each level of the building. The Ground bars must be bonded together, and with the Building Distributor Ground Bar (see specifications for telecommunications system bonding at end of document).

End of Section

5.0 Cooling

Building Distributor room

- .1 Building Distributor room temperature must be maintained between 18 degrees Celsius and 24 degrees Celsius. Heat Load/Dissipation in the Building Distributor room range between 15000BTUs/hr. - 30000BTUs/hr.

Floor Distributor room

- .1 Floor Distributor rooms temperature must be maintained between 18 degrees Celsius and 24 degrees Celsius. Heat Load/dissipation in each Floor Distributor is approximately 2000-5000 BTUs/hr.
- .2 Each Floor Distributor room must, at a minimum, be connected to the building air circulation system.

End of Section

6.0 University Data Centre

Where appropriate, allocate space for a University Data Centre that can accommodate Research, Academic and Administrative requirements. The Data Centre must meet all Data Centre design standards including but not limited to:

- HVAC
- Electrical (includes UPS and generator)
- Conduits for network cabling
- Server racks
- Etc.

End of Section

8.0 Grounding and Bonding

The grounding and bonding of the telecommunications system shall meet all relevant legislations and codes.

All grounding and bonding shall be installed as per:

- TIA-942, Telecommunications Infrastructure Standard for Data Centers
- J-STD-607-B, Commercial Building Grounding and Bonding Requirements for Telecommunications
- TIA/-606-B, Administration Standard for the Telecommunications Infrastructure of Commercial Buildings
- STD 1100-2005, IEEE Recommend Practice for Powering and Grounding Electronic Equipment (IEEE Emerald Book)
- CEC, Canadian Electric Code (CEC)

End of Section

Division 31 – Earthwork

All new construction and renovation projects on Carleton University campuses are required to meet the Carleton University Facilities Design Guidelines. Including from the initial planning and design stages through to the various phases of construction and facilities maintenance and management. They are to mirror planning, design, construction, maintenance, and other facilities supporting University personnel. These documents are to be used as a guideline only on all Carleton University projects and are not to be used for bidding, permitting construction, or any other purpose. Any changes or substitutions must be approved by Carleton University Facilities Management and Planning (CUFMP) and must be submitted in writing. This document is the property of Carleton University. Any use of this document, in part or in whole, for purposes other than a Carleton University project cannot be done without written permission from the University.

Table of Contents

31 10 00 – Site Preparation & Hard Landscaping 3

31 25 00 – Erosion and Sedimentation Control 5

31 10 00 – Site Preparation & Hard Landscaping

General

Design Criteria and Notes:

- .1 Protection:
 - .1 Prevent damage and protect existing fencing, landscaping, existing structures, bench marks, buildings, pavement, surface or underground utility lines which are to remain.
 - .2 Reduce environmental impacts during construction by limiting topsoil removal, stockpiling existing topsoil on site and exposing smallest area of soil at any one time during development.
 - .3 Maintain access roads to prevent accumulation of mud.
 - .4 Integrate finish grading to waste management plan.
 - .5 Cut off unsound branches and cut down trees that could endanger the area to be cleared.
 - .6 All earth work has to be planned and coordinated with FMP and DRM.
- .2 Grading:
 - .1 Slope rough grade away from building 1:100 minimum, and towards catch basins and drainage points, or as necessary to adapt to site conditions.
- .3 Backfilling:
 - .1 Areas to be backfilled to be free from debris, snow, ice, water or frozen ground.
 - .2 Do not use backfill material which is frozen or contains ice, snow or debris.
 - .3 Do not backfill around or over cast-in-place concrete within 3 days after placing the concrete.
- .4 Asphalt:
 - .1 Do not apply primer or tack coat, nor commence laying of asphalt base or binder courses until base surfaces are dry and at least at 2°C, and the ambient temperature is above 5°C.
 - .2 Commence laying of asphalt surface courses only when base or binder course surfaces are completely dry, when atmospheric temperature in shade is at least 10°C and rising, or above 15°C if falling, and the weather is not foggy or rainy.
 - .3 Suspend paving operations two hours before it rains, if temperature drops below specified minimums, and if the surfaces become wet or humid.
 - .4 Provide access to building and Employees' Parking Area at all times. Arrange access points with Owner.

- .5 Do paving operations only when other dust producing operations are completed or stopped and truck movements are not scheduled adjacent to area of installation.
- .6 Finished surfaces should not have a variation of more than 5 mm (3/16") under a 3 m (10'-0") long straightedge in any direction.

Products

- .1 Granular fill material: Clean, angular, crusher run natural stone, free from shale, clay, friable materials, roots and vegetable matter.
- .2 French drains: High density polyethylene resin ringed tubes of 100 mm (4") diameter, or larger, as per ASTM D1248, Type III, category 4 or 5, grade P33 or P34, Class C.
 - Suggested (or equivalent) product: "Big-O" by Big-O Inc.
- .3 Geotextile: Non-woven rootproof polyester fabric non-biodegradable, with a mass of 300g/m².
 - Suggested (or equivalent) product: "7609" by Texel (Solmax).

End of Section

31 25 00 – Erosion and Sedimentation Control

General

Objectives

- .1 Prevent the loss of soil from construction site resulting from storm water runoff, wind erosion and construction activities.
- .2 Prevent the sedimentation of storm sewers and receiving waters.
- .3 Prevent air pollution caused by dust and particulate matter.
- .4 Meet or exceed the requirements of LEED® Canada-NC Version 1.0 Sustainable Sites Prerequisite 1 “Erosion and Sedimentation Control” which specifies compliance with EPA832/R-92-005 (September 1992), Storm Water Management for Construction Activities, Chapter 3, or local erosion and sedimentation control standards and codes, whichever is more stringent.

Description of work

- .1 Implement the Erosion and Sedimentation Control (ESC) measures shown on the project drawings and described in these specifications.
- .2 Install ESC products in accordance with manufacturer instructions and the prescribed installation procedures in the referenced EPA document.
- .3 Inspect ESC measures on a weekly basis and following all significant storm events. If deficiencies are found, make repairs within 24 hours of detection.
- .4 Maintain an ESC inspection log to document observations, deficiencies and corrective actions.

References (subject to change)

- .1 U.S. Environmental Protection Agency, Office of Water. “Chapter 3: Sediment and Erosion Control” and Chapter 4: Other Controls”. Document No. EPA 832-R-92-005 Storm Water Management for Construction Activities.
- .2 Canada Green Building Council. “Sustainable Sites Prerequisite 1: Erosion and Sedimentation Control”. Leadership in Energy and Environmental Design Reference Package for New Construction and Major Renovations (LEED® Canada-NC) Version 1.0.

LEED® construction coordination

- .1 Designate an individual to be responsible for all aspects of LEED® coordination during construction (including erosion and sedimentation control).
- .2 The LEED® Construction Coordinator shall be responsible for:
 - .1 Supervising on-site ESC activities on a daily basis
 - .2 Conducting ESC inspections
 - .3 Coordinating ESC tasks with subcontractors to ensure timely and orderly progress of the work
 - .4 Preparing ESC documentation and submittals
 - .5 Reporting ESC progress to the Owner
- .3 The LEED® Construction Coordinator is to be regularly on-site during construction.

LEED® kick-off meeting

- .1 Prior to start of construction, the LEED® Construction Coordinator shall hold a kick-off meeting with the Owner to review the Erosion and Sedimentation Control requirements. This meeting shall include a review of:
 - .1 Erosion and Sedimentation Control Objectives
 - .2 Erosion and Sedimentation Control Requirements and Procedures
 - .3 Erosion and Sedimentation Control Postings and Submittals

Submittals

- .1 Inspection Checklist – Schedule A
 - .1 Prepare the checklist to include all measures shown on the drawings and described in the specifications.
 - .2 Complete a new checklist with each inspection and keep completed checklists with the weekly inspection log documentation.
- .2 Weekly Inspection Log – Schedule B
 - .1 Complete the log on a weekly basis and keep all documentation on-site and available for review by the Owner.
 - .2 The inspection log shall be completed for each inspection, and must document deficiencies for all measures indicated as “Not OK” on the inspection checklist.
 - .3 Each deficiency must be initialed, and each log must be signed, only after all corrective measures have been completed and documented.
 - .4 Submit all ESC documentation (e.g., inspection checklists and inspection log) to the Owner after final landscaping is completely installed.
- .3 Photographs:
 - .1 A minimum of three (3) digital photographs shall be taken (from various viewpoints) of each ESC measure implemented on-site immediately following installation.
 - .2 A minimum of three (3) digital photographs shall be taken (from various viewpoints) of ESC measure implemented on-site at the end of construction or prior to dismantling, whichever comes first.
 - .3 Submit all digital photographs to Owner for documentation within seven (7) days of being taken.

Part 2 **Products (Not Applicable)**

Part 3 **Execution (Not Applicable)**

Procedures

General Practices:

- .1 Stabilized Construction Entrance (SCE)
 1. Construct an SCE before construction begins at every point where traffic leaves the site and enters onto a public road and/or any unpaved entrance/exit location where there is a risk of transporting mud or sediment onto paved roads.
 2. The SCE must be at least 3.65 m wide, with room for two vehicles to pass at high traffic areas, and constructed from 50 mm diameter clear stone, 150 mm diameter rip rap, and filter fabric with the following characteristics:
 - .1 Grab Tensile Strength: 100 kgs
 - .2 Elongation Failure: 60%
 - .3 Mullen Burst Strength: 195 kgs
 - .4 Puncture Strength: 57 kgs
 - .5 Equivalent Opening: Size 40-80 (US std sieve)
- .2 Site Arrangement
 - .1 All construction trailers and equipment shall be positioned to reduce the disturbance of site. They shall be located close to the current phase of construction to minimize traffic damage to the site.
- .3 Material Stockpiling

Division 32 – Exterior Improvements

All new construction and renovation projects on Carleton University campuses are required to meet the Carleton University Facilities Design Guidelines. Including from the initial planning and design stages through to the various phases of construction and facilities maintenance and management. They are to mirror planning, design, construction, maintenance, and other facilities supporting University personnel. These documents are to be used as a guideline only on all Carleton University projects and are not to be used for bidding, permitting construction, or any other purpose. Any changes or substitutions must be approved by Carleton University Facilities Management and Planning (CUFMP) and must be submitted in writing. This document is the property of Carleton University. Any use of this document, in part or in whole, for purposes other than a Carleton University project cannot be done without written permission from the University.

Table of Contents

32 30 00 – Site Improvements and Amenities 3

32 30 00 – Site Improvements and Amenities

General

Design Criteria and Notes

- All work in this section, including Fence materials, and proper functioning of gates, shall be guaranteed for a period of 5 years for labour and Materials.

Products

Fences

.1 Chain Link Fence:

- .1 Wire mesh: 4.9 mm (6 ga), hot dipped galvanized high-strength steel.
- .2 Pipes: For posts and rails in Galvanized steel, End posts: 89 mm (3½"), 3.42 kg / 300mm (7.55 lbs / 12"). Intermediate posts: 60 mm (2¾"), 1.66 kg / 300 mm (3.65 lbs / 12"). Rails, bracings: 43 mm (1⅞").
- .3 Bottom tension wire: 5 mm (3/16") diameter, single strand, hot dipped galvanized steel.
- .4 Tension bar: 5 mm x 19 mm (3/16" x 3/4") minimum hot dipped galvanized steel.
- .5 Tension bar bands: 3 mm x 19 mm (1/8" x 3/4") minimum hot dipped galvanized steel.
- .6 Finish: In Vinyl coated for mesh, and powder electro-color for other components, black color.
 - Suggested (or equivalent) product: As manufactured by:
 - .1 Frosst Fences.
 - .2 Medallion Fence Ltd

.2 Metal Security Fence in Rectangular Mesh (Ornamental):

- .1 Wire mesh, for rectangular fence fabric: manufactured of 4.9 mm (6 ga) hot dipped galvanized steel wire, with 150 g/m² (0.5 oz/ft²)
- .2 Hot dipped galvanized steel HSS sections, for line and end posts, 76 mm x 76 mm (3" x 3"), at 2490 mm (8'- 2") c.c., or as necessary, with a zinc coating inside and out.
- .3 Finish: In powder electro-color, black color.
 - Suggested (or equivalent) product: "Omega II" by Omega Fence Systems Inc.

Roadway Guardrail

- .1 Removable or fixed Guardrails: Heavy duty roadway guardrail, with undulating cross-section, to withstand slow-moving vehicular impact, complete with HSS supports and bolts and Concrete bases.

Protection

- .1 Fixed Bollard: Made up of concrete, 2135mm high.
- .2 Removable Bollard: Made up of concrete, 960mm or 1220mm high.
 - CU Standard product: "6432" or "6433", with "6439" base (optional) by Central Precast Inc.
- .3 Conical Bollard: Made up of concrete, 1425mm high.
 - CU Standard product: "6431" by Central Precast Inc.
- .4 Parking Lot Divider: Made up of concrete.
 - CU Standard product: "6437" by Central Precast Inc.
- .5 Parking Post: Made up of galv. Steel post on the concrete base, 1370mm or 1830mm high.
 - CU Standard product: "6436" or "6435" by Central Precast Inc.

Site Furnishing and Amenities

- .1 Recycle bins: In PVC enclosures which with (3) engraved identifiers: "WASTE", "GLASS", "PLASTIC", or "CANS". Includes liners and hinged doors. Variable sizes to suit.
 - CU Standard product: "3147", from "SKU 030-470" series by Max.R.
- .2 Park benches: In IPE or composite wood inserts. Different sizes and shapes to suit.
- .3 Bicycle rack: Made of metal elements, marine grade, finished with baked-on polyester powder coating, for vertical or horizontal installation.
 - CU Standard product: As manufactured by Bike Up - Bicycle Parking Systems.

- .4 Planters: In Prefabricated concrete, with exposed aggregate finish. Different sizes to suit.
 - CU Standard product: "6100" series or "6210" series by Central Precast Inc.
- .5 Ash trays: Prefabricated Antitheft, steel /powder coated paint. Bolted from the inside to a concrete paver.
 - CU Standard product: As manufactured by Ikwit - Urban Ashtray & Furniture.
- .6 Picnic tables: In IPE or composite wood or PVC. Different sizes and shapes to suit. Different sizes and shapes to suit.
- .7 Light pedestals: In prepainted steel, with **CU** grained logos, mounted on bases, with the following features:
 - .1 Poles must have an adjustable base-plate in order to level complete assembly.
 - .2 Bases are made from Central Precast, with the molds for the concrete.
 - .3 Lamp post c/w single fixture head, burgundy with glazed glass to match existing fixtures.
The Multi-Voltage is 120-347 c/w fuse holders (Ferraz #atm-5A).
 - .4 Lamps are LED-8029E42C post top multi-voltage, 24w, 4200K c/w E26 Edison base and socket. Socket must be installed in head of lamp post.
 - Use 12' steel poles and 20' composite poles.

Accessories and Finishes

- .1 Aluminum edging: 140 mm (5½") deep, 4.8 mm (3/16") thick, mill finish aluminum edging, in AA-6063-T6 alloy and temper, complete with interlocking stakes 305 mm (12") long.
 - Suggested (or equivalent) product: "Permaloc Cleanline" by Permaloc Corporation.
- .2 Aluminum edging, structural: L-shaped, 55 mm (2¼") deep, 4.8 mm (3/16") thick, mill finish, structural aluminum edging, in AA-6063-T6 alloy and temper, complete with up to 305 mm (12") long, spikes and stakes as required.
 - Suggested (or equivalent) product: "Permaloc StructurEdge" by Permaloc Corporation.

- .3 Recycled plastic edging: synthetic lumber, made of recycled plastic, impervious to moisture, insects, rotting, mildew and graffiti.
 - Suggested (or equivalent) product: "Polyex" by Plastival.
- .4 Plastic edging: made of black extruded PVC, "Commercial" type, 140 mm (5½") deep.
 - Suggested (or equivalent) product: as manufactured by D.C.N. Plastiques.
- .5 Wood edging: In IPE wood inserts.

End of Section